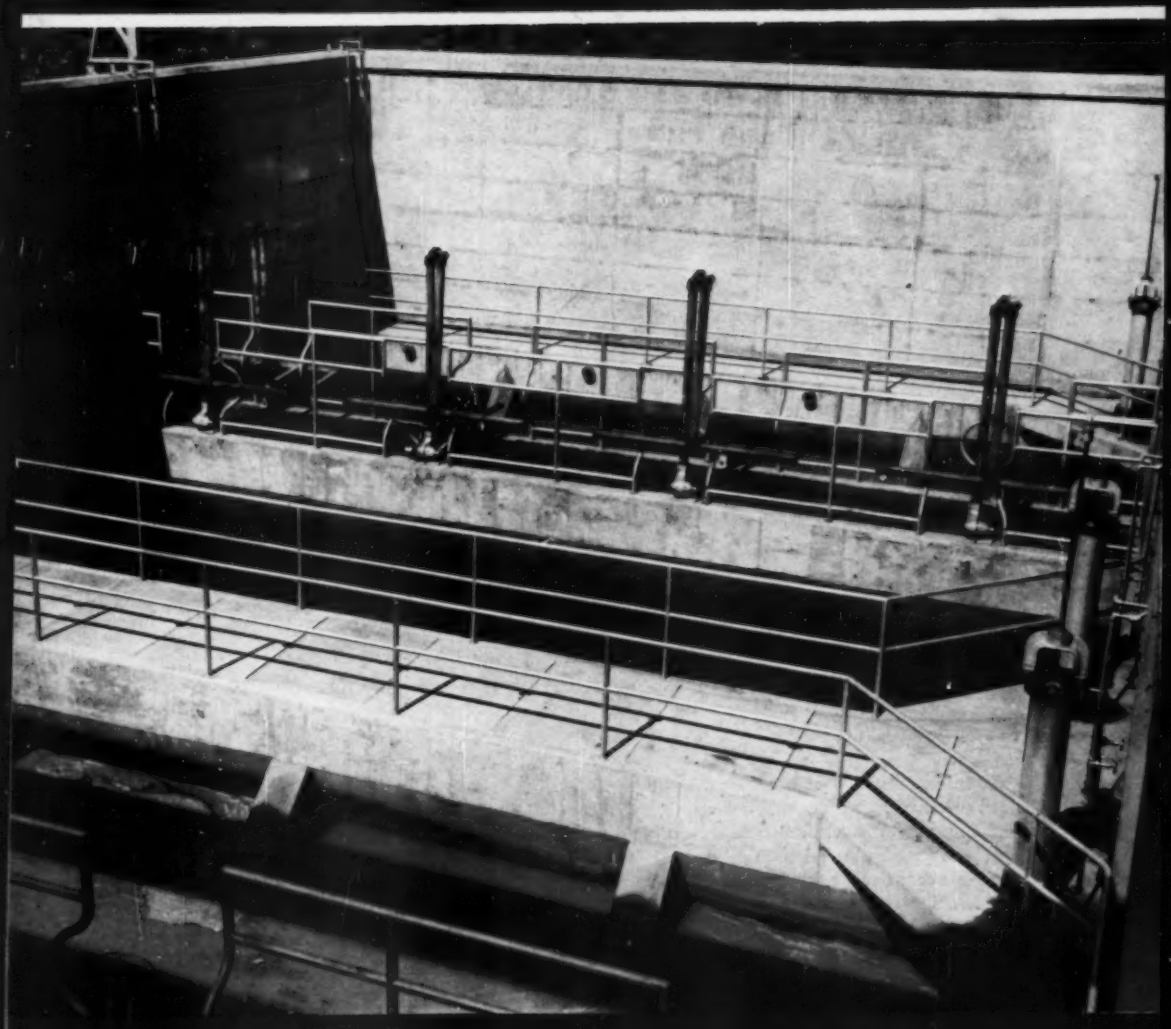
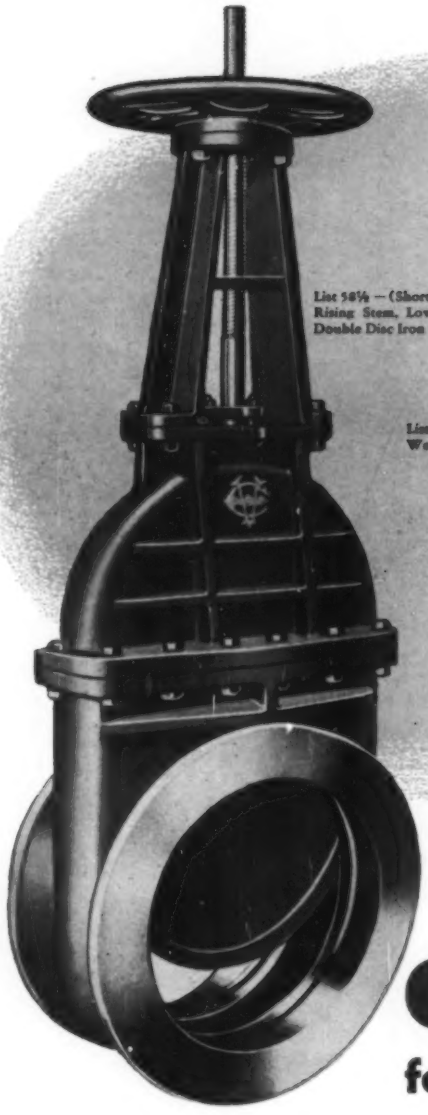
WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL • INDUSTRIAL WASTE TREATMENT





List 58½ — (Short face to face), Rising Stem, Low Pressure, Double Disc Iron Gate Valve

List 25 — Rising Stem, Solid Wedge, Iron Gate Valve

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Be sure to check Chapman first whenever you need standard gate and check valves. Here you'll find iron valves in a complete range of sizes—both solid wedge and double disc types—for a complete range of working pressures from 25 to 800 lbs. for steam, water, oil or gas service. Operation may be by hand wheel, with or without bevel or spur gearing, floor stand, electric motor, hydraulic or pneumatic cylinder.

If, however, you need bronze valves — we have them. Just as we have a complete line of steel valves. And valves of many other types such as tilting disc, iron and steel check valves. Whenever special valves for unusual service are required, Chapman engineers will be glad to help you develop them.

The Chapman Valve Manufacturing Company

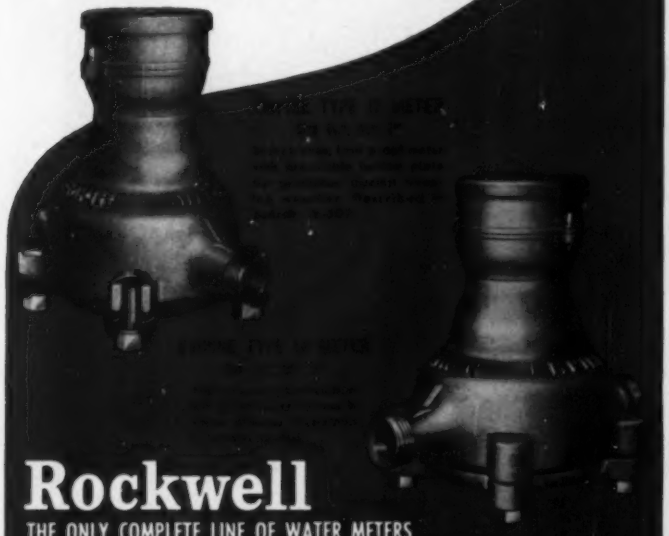
INDIAN ORCHARD, MASSACHUSETTS

THE *EXTRA* VALUE IN ROCKWELL EMPIRE METERS

A BALANCED *OSCILLATING PISTON*

Empire meters alone have the design advantage of a ***balanced*** oscillating piston. This ***exclusive*** measuring element *glides* with a circular motion between the mirror smooth surfaces of a snap-joint chamber. It is built with a ***center web*** both for strength and to ***balance*** water pressure from above and below. Hence the feather weight Empire piston practically floats. Users report Empire meters measure both large and small flows with ***greater accuracy*** . . . and ***for longer periods*** without attention. They earn top revenue.

Write for bulletin.



Rockwell

THE ONLY COMPLETE LINE OF WATER METERS

ROCKWELL MANUFACTURING COMPANY

NEW KIND OF TEST PILOT FOUND IN METER FACTORY

Test pilot recording readings at panel board of electrically controlled test plant

A test pilot who never leaves the ground has been found in Brooklyn. He is the one man control in charge of a new, electrically operated plant that tests water meters for accuracy before they are shipped. He simply turns levers, adjust dials and, presto, the plant is ready to test new meters in batteries up to 240 at a time in four test lanes.

This new meter tester is unusual in that it can be adjusted to duplicate actual field operating conditions. For

Overall view of new meter testing facilities

example, meters going to warm climates can be tested for accuracy and response at the same water temperatures they will encounter in service. Officials of Rockwell Manufacturing Company in whose meter factory the new tester is installed hail the development as a notable advance in the art of measurement accuracy. In equipment formerly available, meters were tested under average water conditions for the entire country. Meters so tested frequently performed differently when put in service. The new, robot controlled test plant is expected to eliminate this difficulty. It is a custom made job designed by Rockwell engineers to meet their exacting requirements for accuracy.

MARSHFIELD, WISC.

Sewage Treatment Plant

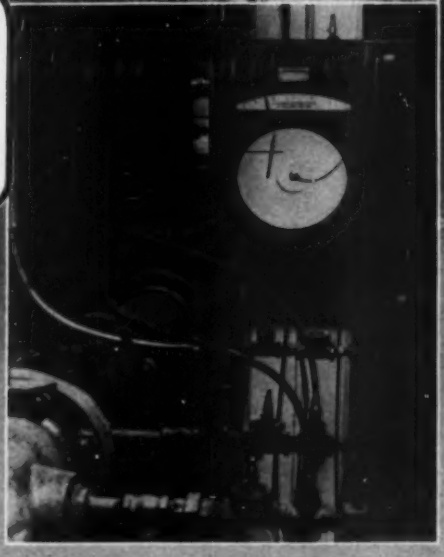
(COMPLETED IN 1948)

The JERRY DONOHUE ENGINEERING CO.
Bruno J. Hartman, *Pres.*
Consulting & Supervising Engineers
Sheboygan, Wisc.

OSCAR WARD
Superintendent, Sewage Treatment Plant
Marshfield, Wisc.

Builders Equipment furnished for the Marshfield Sewage Treatment Plant:

Flo-Watch Totalizer-Indicator-Recorder for metering Raw Sewage passing through Parshall Flume.
6" x 3" VT54 Venturi Tube with Flo-Watch Totalizer-Indicator-Recorder for Raw Sewage.
8" x 4" VT54 Venturi Tube with Flo-Watch Totalizer-Indicator-Recorder for Activated Sludge.
14" Orifice Plates with Flo-Gages.



The Sewage Treatment Plant at Marshfield, Wisc., is a good example of the modern sewage disposal plant—an integrated process, designed throughout for efficiency and economy. Within an area of 5 acres are included all the necessary facilities for aeration, clarification, digestion, filtration, and sludge disposal. Maximum plant capacity is 2.5 MGD. This controlled sewage disposal system provides the utmost in sanitation for a population of 12,000.

As is the case in so many municipal sewage plants, Builders Equipment serves an all-important function at the Marshfield Treatment Plant. Builders Instruments and Meters supply the data on flow needed by Mr. Oscar Ward, Supt., to maintain high efficiency of operation. For Bulletins and information on Builders Sewage Works Equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

"A Radiological Water Monitor," which reassures the public of water safety at all times, is described by M. B. Cunningham, Okla. City's Water Chief • "The Real Costs of Operating and Maintaining Construction Equipment" have been developed from carefully kept records by S. L. Rogers, Distrib. Supt. at Hartford, Conn. • "Effects of Toxic Wastes on B.O.D. Tests" are revealed by C. N. Sawyer and E. R. Herman of the Sedgwick Laboratories of M.I.T. • "Iron Removal and Water Softening" is a reference type of article by D. J. Saunders of the Permutit Co. • "Water Treating Experiences", the series by A. H. Ullrich, of Austin, Tex., is being extended.

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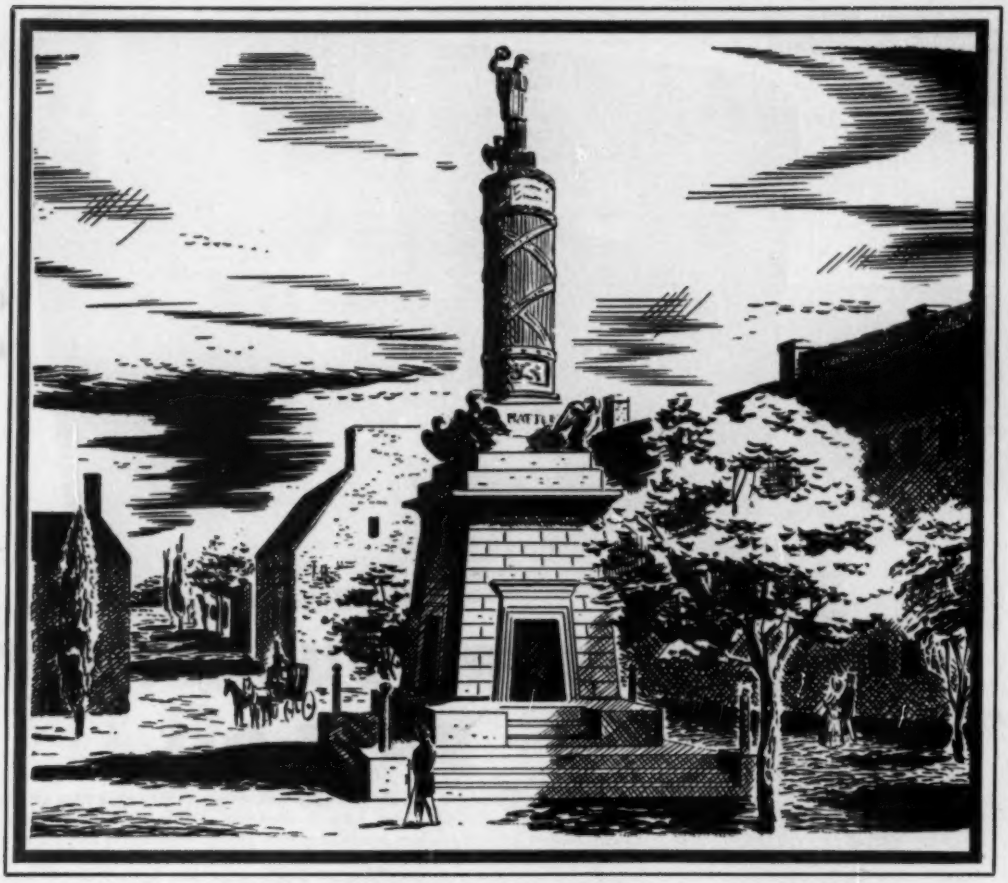

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Baltimore, Maryland has cast iron water and gas mains in service that were installed more than a century ago. In addition, there are more than 28 other cast iron water or gas mains with known records of continuous service for more than 100 years in the older cities of the United States and Canada. Such service records prove that cast iron pipe not only resists corrosion effectively, but is endowed with all the strength factors that pipe laid under city streets must have to meet the stresses imposed by modern conditions of traffic and underground services.

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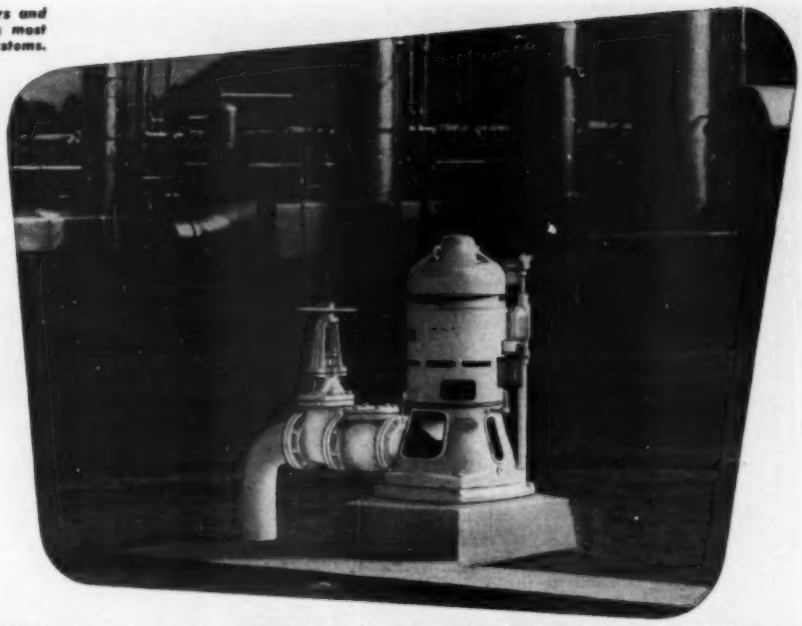

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VERTICAL *Turbine* PUMPS

Another Helping Hand in BOYS TOWN

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All water for the system is supplied by adjacent Omaha, Nebraska. Then the Horton elevated tank, shown at the right, delivers this water under gravity pressure throughout the community. Service is assured around-the-clock . . . even during peak load periods.

Water tanks with radial-cone bottoms are particularly adapted to large capacities because they do not have an excessive range in head. This means a lower average head and therefore lower pumping costs.

The welded steel construction of Horton tanks insures durability, simple maintenance, and clean appearance. Rust and corrosion have no place to hide.

Horton radial-cone bottom tanks are available in standard capacities from 500,000 to 3,000,000 gallons. Horton ellipsoidal-bottom tanks are normally used for capacities from 15,000 to 500,000 gallons.

Write our nearest office for complete information.

THE STORY of the inception and growth of Boys Town belongs to Father Flanagan. For it was through his tireless efforts that this boys' community grew from one five story building in 1927 to today's 67 buildings with 1000 acres of ground. Now some 567 boys of every age, nationality and creed, enjoy the benefits of his great work.

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STRENGTH is vital

Be doubly sure when you specify pipe for mains to be laid under city pavements. Sure that it effectively resists corrosion. Sure, also, that it has the four strength factors, listed opposite, that pipe must have to withstand beam stresses, external loads, traffic shocks and severe working pressures. *No pipe, deficient in any of these strength factors, should ever be laid in paved streets of cities, towns or villages.* Cast iron water and gas mains, laid over a century ago, are serving in the streets of more than 30 cities in North America. These attested service records prove that cast iron pipe not only assures you of effective resistance to corrosion but all of the vital strength factors of long life and economy.

in pipe for city streets

No pipe that is deficient in any of the following strength factors should ever be laid under paved streets.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

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The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

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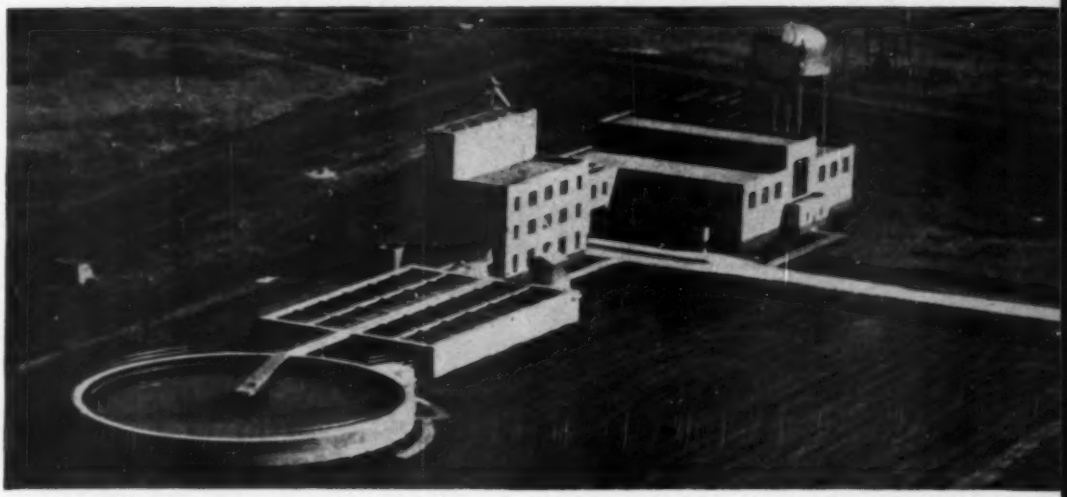
CAST IRON PIPE SERVES FOR CENTURIES

OKLAHOMA CITY



Lake Heffner filtration plant is rated at 15 mgd, and consists of a circular clarifier, flocculator, final settling tank, carbonator, chemical building, filtration building, and wash-water tank. Water flows 4½ miles from the North Canadian River to the plant. Treatment provides water that is as nearly ideal as is commercially practicable.

Unit substation on balcony in filter house includes economical factory-assembled G-E Cabinetrol* panels. This equipment transforms incoming power and safely controls the low-head, induction-motor-driven centrifugal pumps. Note space-saving location.

All pumps in the plant are controlled from this G-E 2400-volt, metal-clad switchgear. This compact assembly, factory-built and shipped as a unit for economical installation, provides maximum protection of personnel.

*Reg. Trade-mark of General Electric Company

GENERAL ELECTRIC

666-60

ACTS NOW... FOR MORE WATER TOMORROW

New Filtration Plant, Powered by G-E Equipment Assures 4-year Storage Supply

Far-sighted planning by municipal officials of Oklahoma City has resulted in the addition of the Lake Heffner Filtration plant to the city's water system. Now this progressive city need have no fear of its water supply running short for many years to come. Between the new installation and the previously existing Lake Overholser plant, there is a combined surface storage that represents about a four-year supply of water at the present rate of consumption.

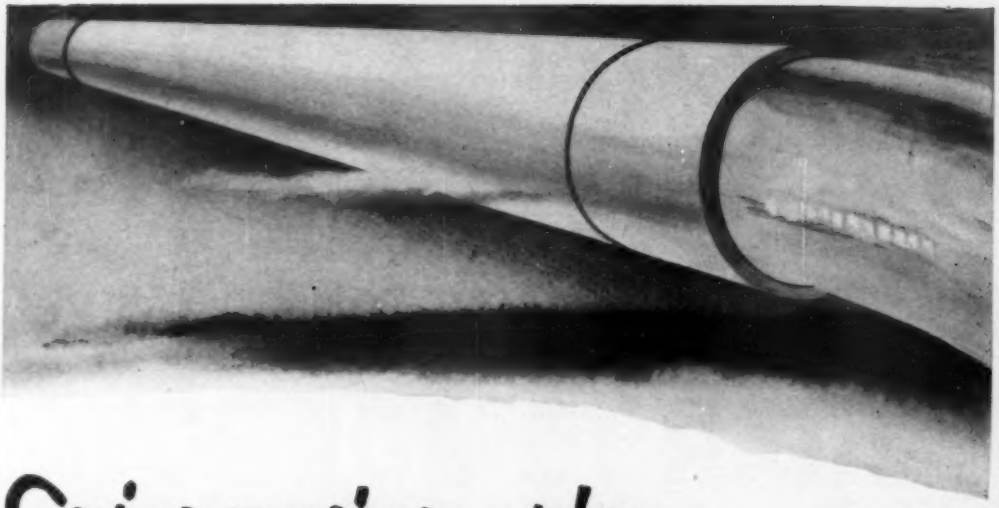
To help assure dependable operation of the pumps in the Lake Heffner plant, General Electric motors, control, power-distribution and switching equipment were selected. This assurance of dependability is based on the fact that General Electric has been furnishing drives, power-distribution systems and process controls for water plants, and numerous other industries, for many years. Out of this rich background of experience has come the co-ordinated G-E water-plant equipment, notable for its reliability.

General Electric can help you, your consulting and city engineers, and your contractors in developing the electrical system for your water supply. The best time to use this help is in the planning stage of your modernization program. A call to your G-E representative at this time will go a long way toward making your water-supply program a success. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

The 2-mgd wash-water centrifugal pump, right, is powered by a G-E Tri-Clad* 2300-volt, 40-hp motor. Left rear, are two 5-mgd distribution-system centrifugal pumps driven by G-E 2300-volt, 300-hp synchronous motors.

This section of the pump room on the ground floor of the filter building shows a G-E 2300-volt, 600-hp, 1200-rpm synchronous motor that drives the 10-mgd distribution-system centrifugal pump in the background.

CO-ORDINATED WATER-PLANT ELECTRIFICATION



Saving precious water for a thirsty

Municipal consumption of water in the United States has risen from two billion to over twelve billion gallons per day in the last fifty years.

In many areas, this rapid increase is posing a serious problem. It means that water supplies must be conserved to the limit if they are to continue to meet an ever-growing demand.

It is not surprising, therefore, that more and more water-works officials are seeking ways to cut down on water losses as one practical step toward the solution of this problem.

Since recent studies indicate that many localities are losing as much as 10% of water pumped because of underground leakage, an important question to be answered in any water conservation program is this: "How can I plan to reduce this major cause of water loss to a minimum?"

Community after community has found the answer in Transite Pressure Pipe.

The unusual success of Transite Pipe in combatting underground water losses is due to a combination of two factors: (1) the design of the Simplex Coupling used for assembly, and (2) the ability of the pipe to maintain its strength in service.

Because flexibility is engineered into the Simplex Coupling, this factory-made joint is virtually unaffected by pipe line stresses that so often result in the loosening and failure of conventional type joints. No particular skill is required for its proper assembly, which is readily checked in the trench by means of a simple gauge immediately after the pipe ends are joined.

Moreover, Transite's maintained strength provides a further safeguard against costly underground water losses. In thousands of installations representing a wide variety of municipal soils, this asbestos-cement pipe has proved its exceptional ability to resist corrosion . . . to maintain its strength under conditions which have seriously impaired the structural integrity of other pipe materials.

Reducing the amount of "water pumped but not paid for" on your books—a saving in dollars as well as water—is only one of many important economies which Transite Pipe can offer you. Savings on installation, savings on pumping costs, savings on maintenance . . . these are further sound reasons why you will want all the facts about this modern asbestos-cement pipe developed and produced by Johns-Manville to carry water more efficiently.

For complete information write Johns-Manville, Box 290, New York 16, N.Y.

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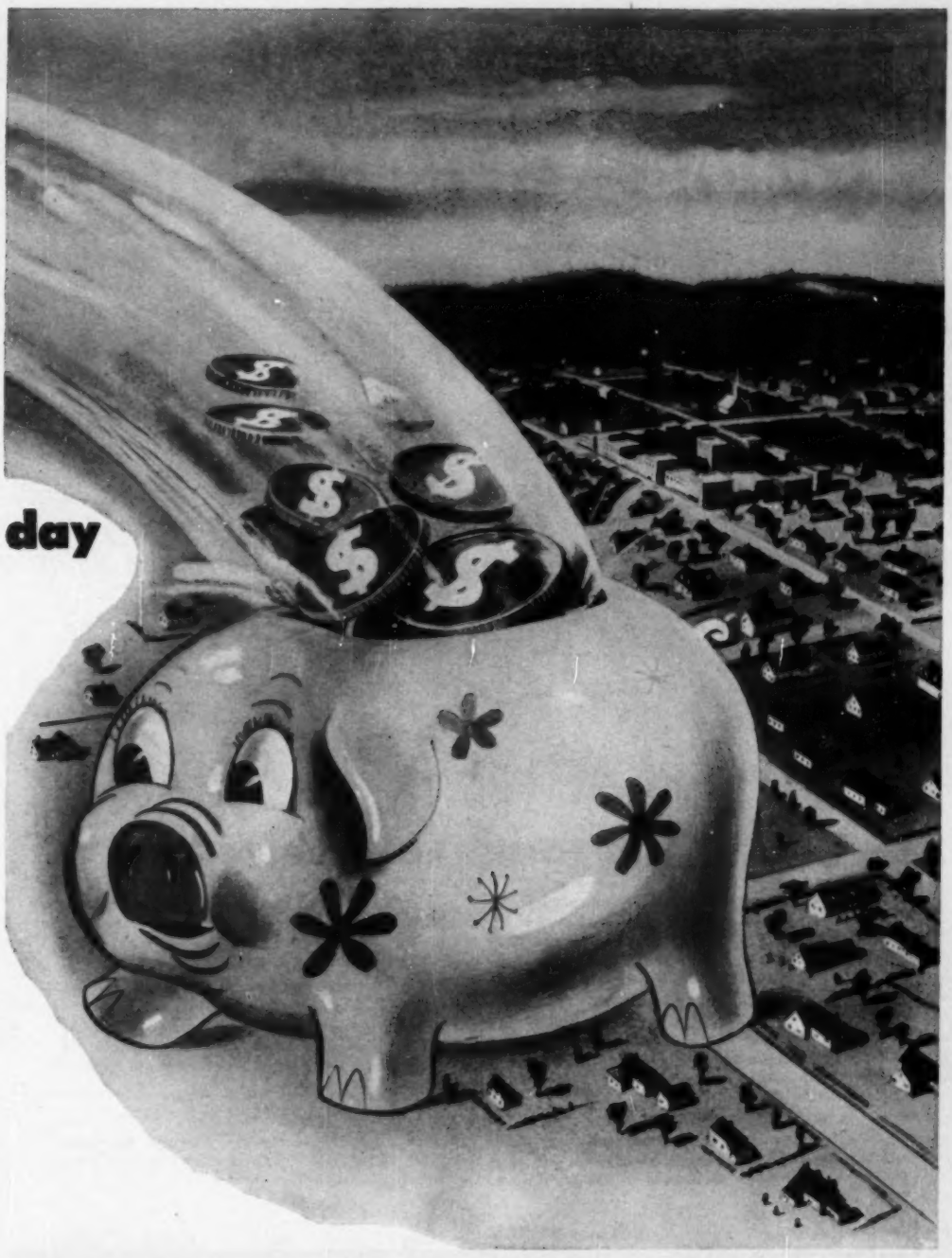
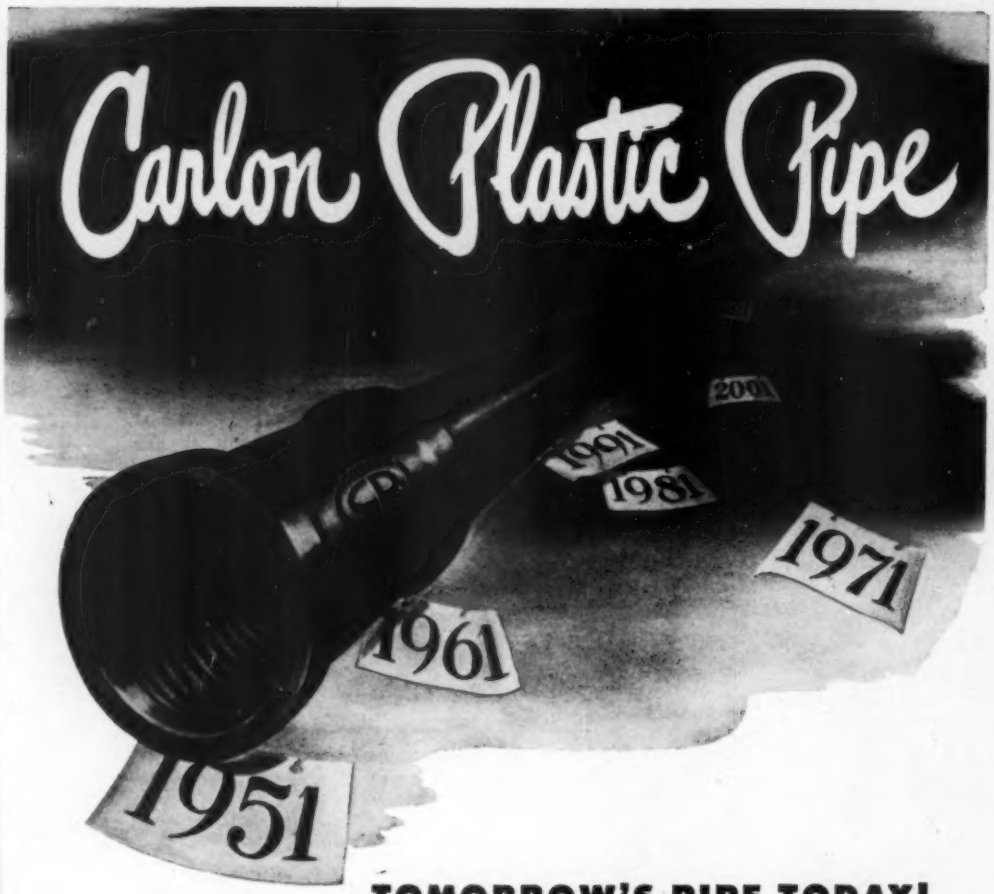
Johns-Manville



TRANSITE PRESSURE PIPE

Transite is a registered Johns-Manville trade mark



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C-151-B

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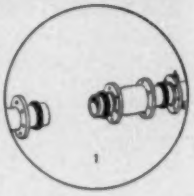
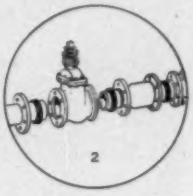
...specify EDDY Cutting-in Valves and Sleeves

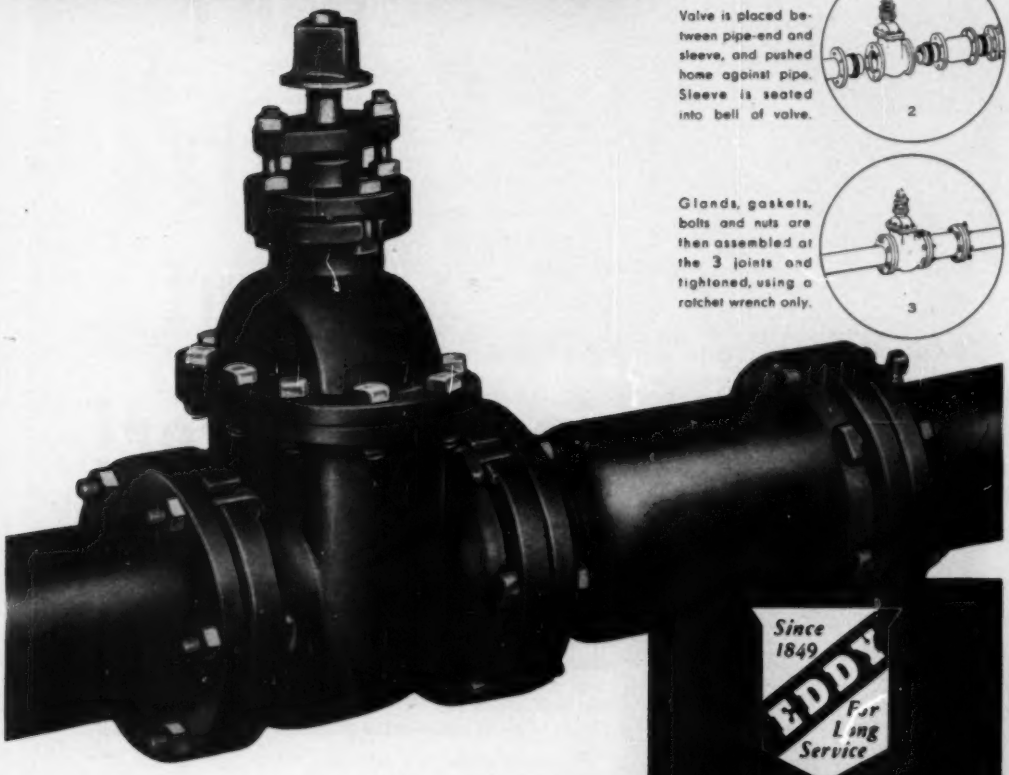
After excavation and removal of section of pipe, glands and gaskets are placed on pipe and sleeve. The sleeve is then pushed into position.



Valve is placed between pipe-end and sleeve, and pushed home against pipe. Sleeve is seated into bell of valve.



Glands, gaskets, bolts and nuts are then assembled at the 3 joints and tightened, using a ratchet wrench only.



Since 1849 EDDY For Long Service

EDDY
VALVE COMPANY
A Subsidiary of James B. Clow & Sons
WATERFORD, NEW YORK

Starting with step "1" above, two men with a ratchet wrench can install an Eddy Mechanical Joint Cutting-in Valve and Sleeve on an existing pipeline in less than 25 minutes. Every joint is bottle-tight under pressure, without caulking or lead-melting. Thus, the work can be done in any kind of weather, or in a flooded trench. Valves meet AWWA specifications; are available in 3 to 12" sizes for sand-cast and centrifugally-cast iron water pipe. Stock up now, for speedy installations.

Don't worry about pipe diameter!

DRESSER STYLE 82 SLEEVES MAKE TIGHT, PERMANENT REPAIRS ON ANY CLASS OF CIP

No need to let off-size pipe hold up your repair when every minute counts. The Dresser Style 82 Adjustable Repair Sleeve, with its interchangeable sections, has an adjustment range sufficient to provide a close fit on all classes of cast iron pipe—A through D.

Measuring tape supplied with sleeve indicates the proper combination of sections. Gaskets come already positioned; no trimming or fitting. One man with a wrench can make a permanent, bottle-tight repair in 10 minutes or less. Furnished for 4", 6" and 8" CIP. Also ideal as tapping sleeve.

Write today for literature and prices.

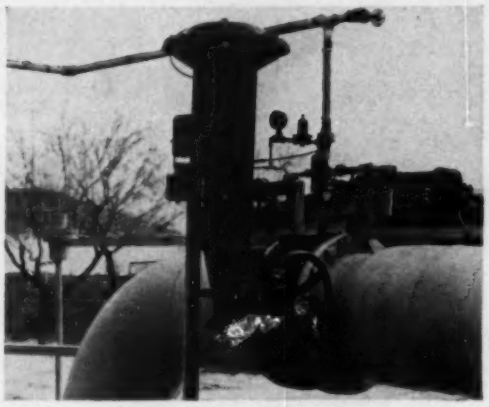
Dresser Style 82 Sleeve being installed over break. Note that nuts on all bolts are at the top—easy to tighten.

DRESSER "ADJUSTABLE" SLEEVES

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries) — In Texas: 1121 Rothwell St., Houston — In Canada: Dresser Mfg. Co., Ltd., 629 Adelaide St., W., Toronto — Sales Offices: New York, Philadelphia, Chicago, Houston, San Francisco.

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



Minimum Pressure Drop
SAVES POWER

The beveled vane of an R-S Valve seats firmly against the valve body to produce commercially tight shut-off with metal-to-metal seat. A rubber seat produces drip-tight closure. In the open position the streamlined vane creates a Venturi action. Pressure drop in R-S Valves is low, and they therefore produce substantial savings in pumping costs.

Illustration shows a heavy duty R-S Valve used in the water system to a compressor house. Valve is equipped with diaphragm motor, handwheel control with self-locking worm and gear and declutching mechanism together with outboard bearing for operating shaft with goose neck support.

Every R-S Valve is engineered and constructed for rugged service and provided with such safety factors that it will give complete satisfaction in the service for which it is designed. Consult with your local R-S Valve Engineers or write direct.

R-S PRODUCTS CORPORATION
4600 Germantown Avenue, Philadelphia 44, Pa.
An S. Morgan Smith Company Subsidiary

No. 579—6-inch 15-pound Direct Action Float Valve with counter-weight assembly.

No. 628—Solenoid Trip Valve is used for emergency service. The solenoid can be arranged with the counter-weight mechanism to open or close the valve and hold it there in one position or the other. If for any reason the solenoid functions, the latch is tripped, which permits the counter-weight to open or close the valve by gravity. The assembly is suited to shut off the flow or to open a vent and requires manual reset. Can be constructed of any metal or alloy and in various sizes for air, gases, steam, oil, hydraulic and other services.

No. 677—1500-pound Welding End Steel Valve for superheated steam service. A.S.M.E. standards with heavy duty handwheel control.

No. 795—Three-inch 3-way Valve Type No. 733 utilizing standard tee and two wafer valves with extended handwheel control.

P.F.T.
CONTROLLED DIGESTION for the HAMPTON ROADS AREA, VIRGINIA

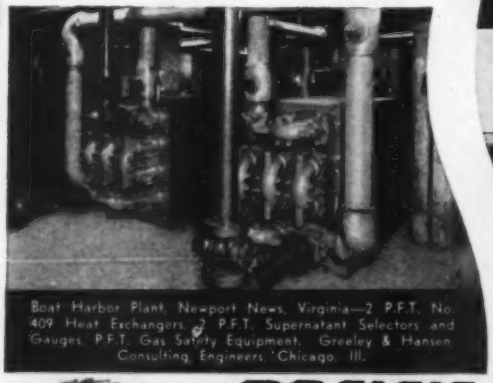
Lambert's Point Plant, Norfolk, Virginia—4 P.F.T. 60' Floating Covers, 2 P.F.T. No. 750 Digester Heaters and Heat Exchangers, 4 P.F.T. Supernatant Selectors and Gauges, 4 P.F.T. Floating Cover Gauge Boards, P.F.T. Gas Safety Equipment. Aldrich & Buck, Consulting Engineers, New York, N. Y.

The four new sewage treatment plants built to serve the communities in the Hampton Roads area all embody P.F.T. Controlled Digestion Equipment.

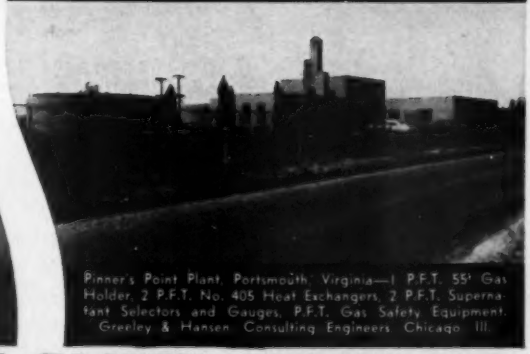
P.F.T. Floating Covers on digestion tanks, P.F.T. External Heating of Sewage Sludge undergoing digestion, P.F.T. Supernatant Liquor Selectors and P.F.T. Gas Safety Equipment are among the P.F.T. units insuring most efficient operation of these plants, pictured here.

This progressive program for waste treatment was carried on cooperatively by the Hampton Roads Sanitation District Commisson and the City of Portsmouth. The Pinner's Point Plant was built by the City of Portsmouth and the other three plants by the Hampton Roads Commission.

Army Base Sewage Plant, Norfolk, Virginia—2 P.F.T. 80' Floating Covers, 2 P.F.T. Supernatant Selectors and Gauges, P.F.T. Gas Safety Equipment. Aldrich & Buck, Consulting Engineers, New York, N. Y.



Boat Harbor Plant, Newport News, Virginia—2 P.F.T. No. 409 Heat Exchangers, 2 P.F.T. Supernatant Selectors and Gauges, P.F.T. Gas Safety Equipment. Greeley & Hansen, Consulting Engineers, Chicago, Ill.



Pinner's Point Plant, Portsmouth, Virginia—1 P.F.T. 55' Gas Holder, 2 P.F.T. No. 405 Heat Exchangers, 2 P.F.T. Supernatant Selectors and Gauges, P.F.T. Gas Safety Equipment. Greeley & Hansen, Consulting Engineers, Chicago, Ill.

P.F.T. PACIFIC FLUSH TANK CO.

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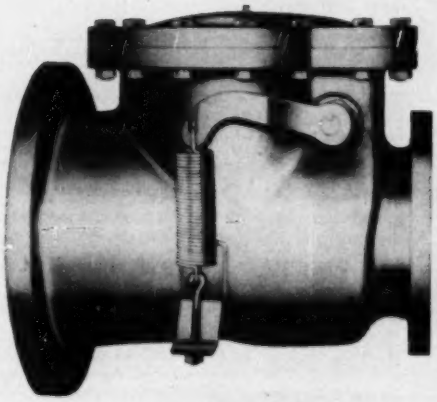
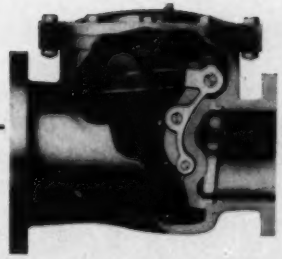
Seat without **SLAM**

THERE'S always possibility of serious SLAM trouble on pump shut down, especially where gradient is steep or where pumps are manifolded and shut down individually. Rensselaer check valves solve this problem, END this trouble—yet their construction is simple, and head loss comparatively low. Their lever-and-adjustable-spring-construction eliminates SLAM by seating the gate at the same instant the water column in the discharge line comes to rest. These valves are ideal for pumping plants; water, oil, gasoline; chemical and process industries; marine service, drydocks; fire protection systems. For complete data, see new Catalog H.





See ***Heavy Stainless Steel Main Hinge Shaft...Heavy Solid Bronze Gate Hinge...Stainless Steel Key ...Dual Stainless Steel Gate Pins...Rugged Cast Iron Bronze Mounted Gate. See your Rensselaer Representative for seasoned advice on all our products.***

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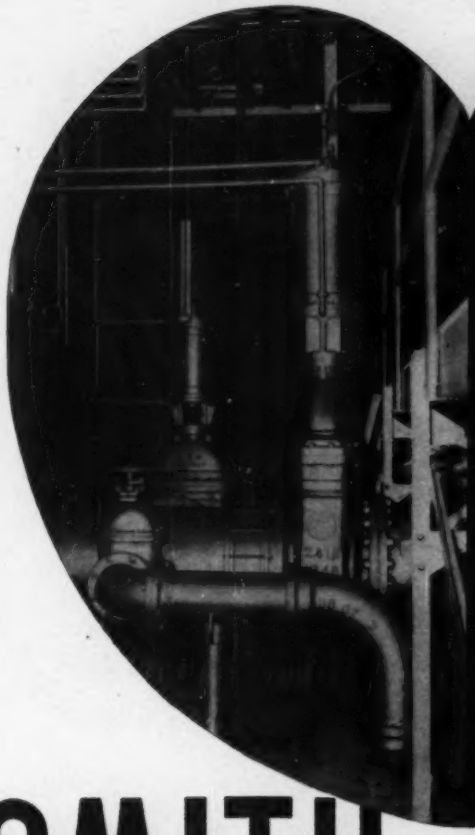

THE HEART OF THE RICHMOND FILTER PLANT

SMITH VALVES

Heart of the new Richmond Filter Plant are a number of Smith-designed, Smith-built, Richmond Specification 300 lb. test Pressure Gate Valves. Valves vary from 8" to 30" in size and are continually being opened or closed for accurate regulation of the flow of raw water, wash water and filtered water. Most of the Valves are hydraulically operated of the Square Bottom Case and Disc Type with wash water Valves provided with throttle track construction. Long life is assured by the Square Bottom construction which prevents the downstream disc tilting into the port opening and minimizes disc and seat ring wear. The Cast Iron Brass Lined Hydraulic Cylinders were fitted with limit switches with red and green lights indicating the fully closed or fully open Valve positions. This construction eliminated the need of complicated mechanical position indicators. Wash water piping expansion and contraction is compensated for by using Valves with a flanged and a plain end to accept a mechanical joint coupling. All Valves supplied by Smith for the Richmond Filter Plant were skillfully designed, engineered and ruggedly constructed for dependable long life service under frequent and severe operating conditions. Write for information on Smith Filter Plant Valve design.

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FOR GREATER EFFICIENCY

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IF YOU'RE interested in sewage treatment, you want to use just enough chemicals to settle out the solids. And if you're interested in wastes treatment, you want to use just enough chemicals to effect neutralization and render the effluent harmless.

In either case, too much chemical addition means costly waste and too little means insufficient treatment. An *ElectroniK* pH Controller will automatically govern addition of chemicals in proper amounts and provide a permanent record of pH value . . . continuous assurance that your treatment of sewage or wastes is operating at peak efficiency.

For unusual sensitivity to changing conditions, for accurate and permanent record, for corrective action without delay . . . the *ElectroniK* pH Controller is your best bet. Call in your local Honeywell engineer for a discussion of your particular pH problem . . . he is as near as your phone. And write for a copy of Catalog 15-12. MINNEAPOLIS-HONEYWELL REGULATOR Co., *Industrial Division*, 4475 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

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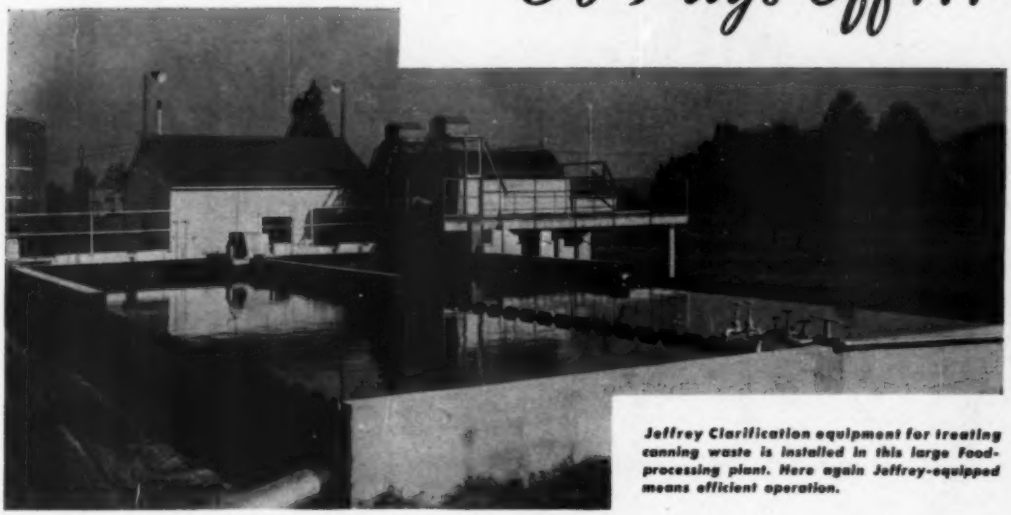

Jeffrey Clarification equipment for treating canning waste is installed in this large Food-processing plant. Here again Jeffrey-equipped means efficient operation.

Industrial Waste is the Peck's Bad Boy in nearly every plant . . always in bad with the neighbors as well as State Pollution Control Commissions.

Clarification of industrial waste need not be such a bad problem. Jeffrey has the facilities for proper and efficient waste treatment . . can help you keep the nation's waters clean. For meeting exacting specifications we can furnish Collector mechanisms for Grit Chambers and Settling Basins, Screens, grease and oil Skimmers, Flocculation equipment, etc., backed by years of experience in designing and building the best in Sewage and Water treatment equipment.

We will be glad to send you some of the names of outstanding plants in which Jeffrey equipment is doing a real job on the purification of sewage and concentrated organic wastes . . and paying off. May we hear from you?

Bar and Disc-type Screens
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We make absolutely no pretense of knowing how much chlorine you should use, or how you should use it. We do claim to know a great deal about shipping, handling and storing chlorine, safely. Our technical advisers are safety experts. They will inspect your chlorine procedure and contribute their highly specialized knowledge to your operations.

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New Million Dollar Hospital Includes Process Oxidators as Clarification Units For Modern Sewage Treatment Plant!

Main building of Pioneer's Memorial Hospital, Brawley, Calif.

General view of plant showing headworks, Oxidators and digester. Nurses home in background.

THE NEW million dollar Pioneer's Memorial Hospital at Brawley, California, is modern in every detail. The sewage treatment plant, which is in close proximity, was designed to include the finest and most up-to-date equipment. Process Engineers Incorporated are proud that Process Oxidators were chosen as the clarification units.

The dual stage bio-oxidation plant was designed for a population equivalent of 1500 and a flow of 150,000 gallons per day. The two 22 ft. dia. Process Oxidators are arranged for parallel or series operation to be used with or without chemical. Sewage plant designed by Quinton Engineers, Ltd. Prime Contractor: F. E. Young Construction Co. Mechanical Contractor: E. O. Nay Co.

Process Oxidators are now in operation ranging from 15′ in diameter to 115′ in diameter. Every installation has meant lower initial expenditures and higher removal of suspended solids and BOD at greatly reduced cost.

Primary Oxidator. Note aeration in center well, lack of scum and clarity of sewage in sedimentation compartment

Patented and Patents Pending

Send for Bulletin 106 for information about this new development in sewage treatment. If you have a particular problem, contact one of the offices below and a specialized engineer will be glad to be of service to you.

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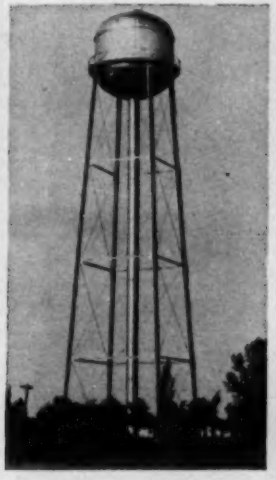

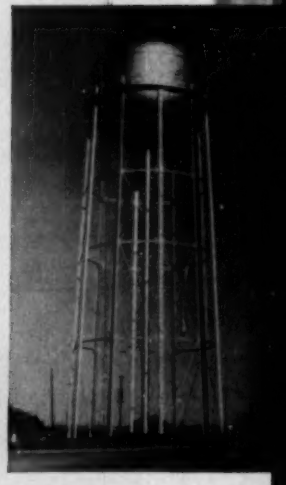

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—SAFETY—SERVICE—SATISFACTION—

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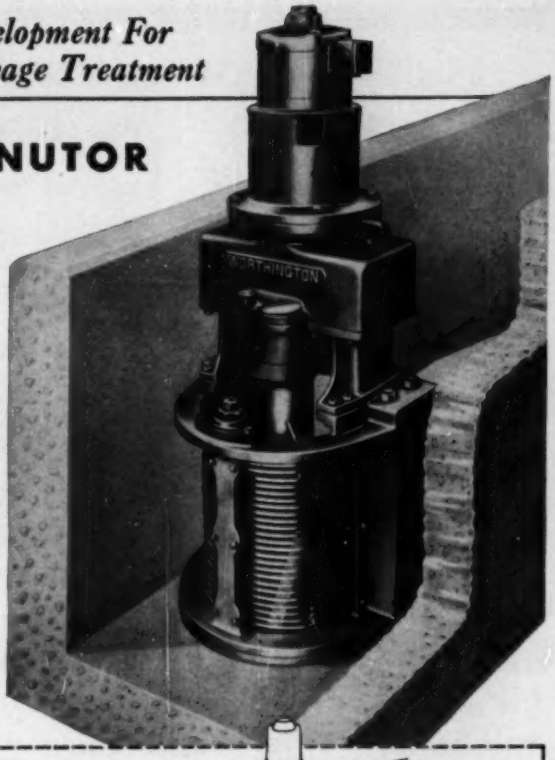
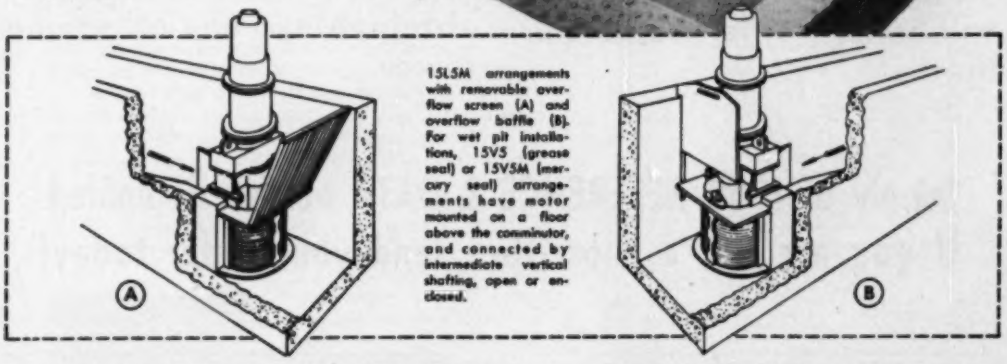
- **Provision for overflow screen or baffle by means of a supporting flange.**



The 15C5 Worthington comminutor arrangement for continuous, automatic sewage solids cutting. This unit is designed for a .3 to 2.3 mgd flow range in a channel of 3 feet maximum depth. Standard grease seal supplied is suitable for water depths up to 22 inches.



15L5M arrangements with removable overflow screen (A) and overflow baffle (B). For wet pit installations, 15V5 (grease seal) or 15V5M (mercury seal) arrangements have motor mounted on a floor above the comminutor, and connected by intermediate vertical shafting, open or enclosed.

In many installations infiltration subjects comminutors to peak flows and submergences beyond their maximum capacities. Only Worthington comminutors can be supplied with both a mercury seal and an overflow screen or baffle to handle this problem.

The mercury seal automatically protects the unit's internal parts up to a reasonable submergence. The gear head motor is mounted on a motor base extension pipe above high water level; channel depth may be over 3 feet. The removable overflow screen provides screening at the comminutor's overflow without causing troublesome upstream conditions, and occasional accumulations may be raked down into the unit. Or, an overflow baffle may be used to back the sewage up through the by-pass screen, preventing overflow.

Many Other Advantages

of the Worthington comminutor combine for rapid, continuous, automatic comminution — and for the long, trouble-free service life that proves *there's more worth in Worthington.* Write for bulletin W-2010-B3, and for drawings of arrangements best suited to your own application. Or contact our nearest District Office. *Worthington Pump and Machinery Corporation, Harrison, N. J.*

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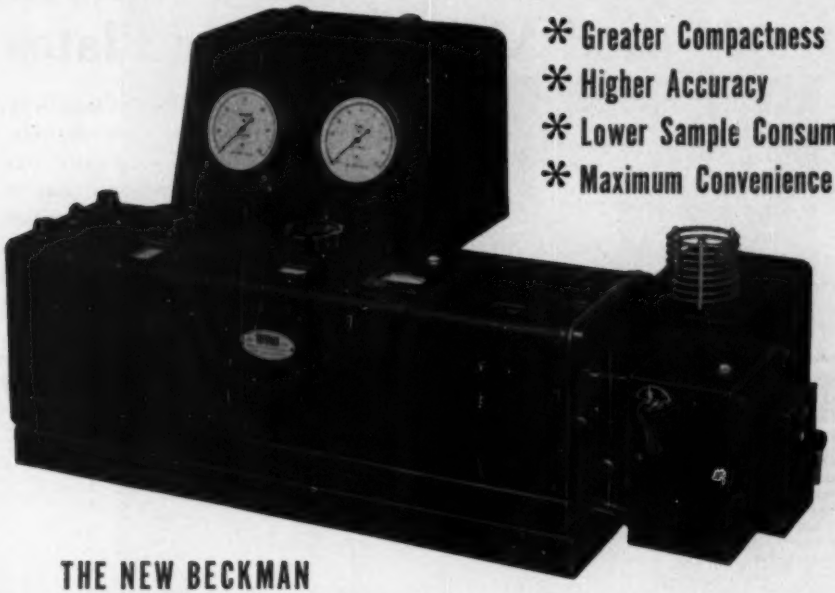

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Illustration at right shows atomizer-burner actual size.

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- The atomizer requires only about 2 ml of sample solution per minute, and a sample of 1 to 3 ml is ample for determination of several constituents.
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Chemical and Physical Properties of Fused Alumina Filter Plates

Norton Alundum* porous plates, unaffected by acid, neutral and slightly alkaline liquors, combine uniform porosity with great strength.

Made of fused alumina, fired to at least cone 12, Norton Alundum porous plates are relatively unaffected by acid, neutral and slightly alkaline liquors. The high alumina glass bond may be affected by strong and hot sodium and potassium hydroxides and by hydrofluoric acid. The following table shows the results of solubility tests under exacting conditions with standard 12" x 12" x 1" Norton Alundum porous plates.

SOLUBILITY TESTS

Solution	Strength in Percent	Percent, Cumulative Loss — Same Plate Alternating Hot and Cold		
		Loss at 10 Days	Loss at 20 Days	Loss at 30 Days
		75 Hrs. at 85-100° C. 169 Hrs. at 20° C.	131 Hrs. at 85-100° C. 349 Hrs. at 20° C.	192 Hrs. at 85-100° C. 528 Hrs. at 20° C.
Phosphoric Acid	85.00	.373	.522	.654
Phosphoric Acid	42.50	.290	.362	.394
Sulphuric Acid	96.00	.326	.444	.488
Sulphuric Acid	25.00	.391	.494	.578
Nitric Acid	70.00	.149	.187	.232
Nitric Acid	22.00	.130	.167	.234
Hydrochloric Acid	35.00	.354	.528	.674
Hydrochloric Acid	20.00	.292	.352	.397
Hydrofluoric Acid	.25	.602	.644	.644
Sulphuric Acid Nitric Acid	1/5 of 96.00 1/20 of 70.00	.188	.318	.388
Ammon. Hydroxide	28.00	at 20°C. .046	at 20°C. .057	at 20°C. .062
Sodium Hydroxide	10.00	.937	1.453	2.302
Calcium Hydroxide	Sat. Sol.	at 20°C. .032	at 20°C. .046	at 20°C. .062
Ammonium Chloride	10.00	.041	.053	.076
Zinc Chloride	10.00	.084	.123	.142
Zinc Chloride	5.00	.032	.044	.052

NOTE Only in the case of sodium hydroxide were edges of plates affected. A slight rounding was noticeable as was to be expected.

UNIFORM PERMEABILITY

Because of Norton's patented "Controlled Structure" process, Alundum porous plates meet extremely rigid specifications for uniform permeability. The size and number of open pores determine permeability. The following table gives approximate pore sizes for different porosities and permeabilities. Permeability is given in cubic feet of air passed per minute on a dry plate 12" x 12" x 1" under 2" water pressure.

Permeability	Percent of Pore Space by Volume	Avg. Dia. of Pores
4 cubic feet	36	0.09 mm.
20 cubic feet	35	0.21 mm.
40 cubic feet	34	0.30 mm.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

GREAT STRENGTH

The following table of tests on standard Alundum 12" x 12" x 1" porous plates of various permeabilities indicates the ability of these plates to operate under high pressures and to resist breakage and chipping due to handling and cleaning.

Average Permeability of Dry Plate, cu ft/min/sq ft/in. thick. /at 2 in. Water Pressure	Average Modulus of Rupture, psi		Breaking Load when Wet Plate is Supported on Four Sides with ½" Bearing	
	Dry	Wet	Ft. of Water	#/sq. in.
121.0	1670	1465	97	42
80.9	1950	1685	110	48
37.8	2684	2235	147	64
16.9	3045	2644	175	76
4.1	3770	3716	246	107

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All of the foregoing data, as well as detailed installation and cleaning instructions, are contained in a highly informative 16 page bulletin. To get it, contact your nearby Norton representative or write direct. NORTON COMPANY, 822 NEW BOND ST., WORCESTER 6, MASS.

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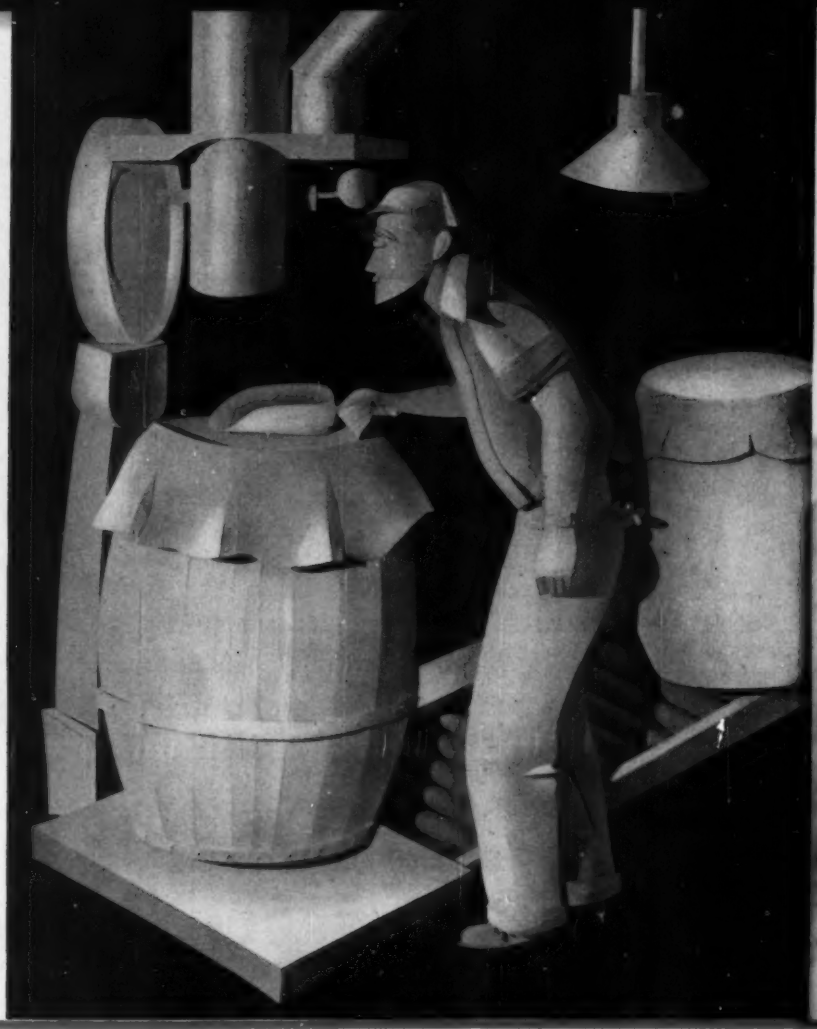

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- NIALK* Caustic Potash
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- NIALK Caustic Soda
- NIALK TRICHLORethylene
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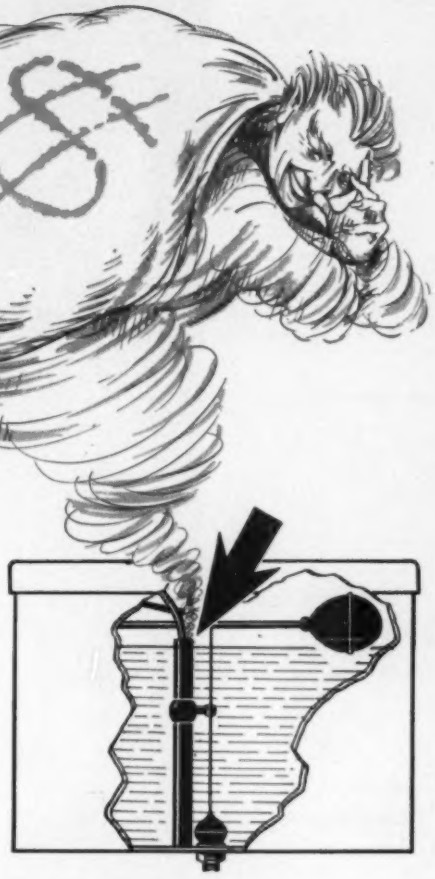

Silent, unsuspected, the overflow pipe has been found by experience to be one of the largest water-wasters, the biggest thief of water revenue. Running over steadily, at low rates of flow, its leakage never registers on meters not maintained in good condition. In such cases, a not unusual leakage of ¼ gallon a minute goes unaccounted and unpaid for—amounting to over 10,000 gallons a month!

Be sure your repaired meters register at least

90% at ¼ gpm

Of unaccounted-for water, possibly more can be attributed to under-registration of meters than to any other single cause

Surveys show that 13% of all water passing through ⅝" meters is used at about ¼ gallon per minute. So you can readily see the importance of having your repaired meters register at least 90% at that rate of flow.

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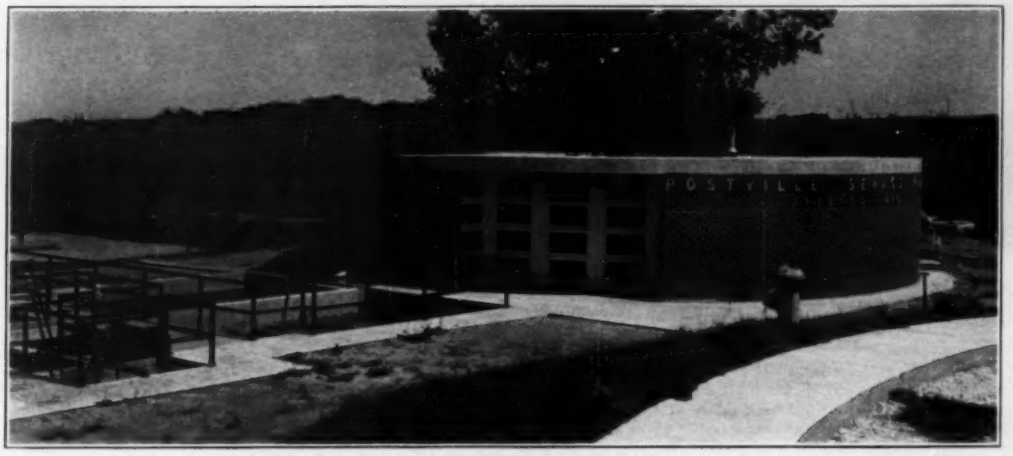
WATER & SEWAGE WORKS

VOL. 99, NO. 2 • A GILLETTE PUBLICATION • FEBRUARY 1951



Postville, Iowa—A 1950 plant—PFT Digester, Preaeration and Filter

Sewage and Industrial Waste Treatment 1950 - A Review

by
RALPH E. FUHRMAN, *Superintendent, Sewage Treatment Plant Washington, D.C.*
(Pres. Federation Sew. & Ind. Wastes Assn.)

IMPETUS given to stream pollution abatement by state and federal legislation characterized the year 1950. The number of waste treatment plants under construction, which in the previous year totalled about a thousand, continued to grow. The construction activities of the year were probably increased as a result of the combination of planning done during the war for postwar execution and the resolution of the financial and materials shortage situation that has existed since the war. The number of articles that appeared in the literature on various phases of stream pollution and waste treatment was probably an all time high. The problem created by radioactive wastes received more attention and the increased use of garbage grinders and synthetic detergents altered the composition of domestic wastes more than in any previous year.

Federation Activities

The 1950 year was marked by "Federation" taking on a slightly different connotation. At the October Board of Control meeting, its name was changed to "Federation of Sewage and Industrial Wastes Associations." The customary annual growth of the Federation did not occur, but no significant loss occurred in spite of the increase in dues in 1950.

During 1950, the Federation released one publication of outstanding value: the important Twenty Year Index of the first 115 numbers of the *Sewage Works Journal*. Work on this publication took many months and it is truly an exceptional volume. It represents the editorial effort of W. H. Wisely, Executive-Secretary—Editor of the Federation, and George E. Symons, Managing Editor, *Water and Sewage Works*.

There are three primary divisions of the Index: In the author index are listed all papers printed in the *Journal* under the author's name. In the subject index are listed article subjects in various classifications with a concise reference to the subject matter contained in the paper rather than the nominal title of the paper. The geographical index gives, for the first time, lists of articles published in the *Journal* by cities and states of the United States and by cities of for-

Los Angeles, Calif.—245 mgd. Hyperion Treatment Plant—Dorrco Digesters, etc.

eign countries. The 8800 entries in the Index were compiled by a page by page search.

The Federation's interest in the industrial wastes field, as exemplified now by its new name, goes back many years. It has long had an industrial wastes committee and all committees have enlarged their interests to include the interests in this important field. Editorial space devoted to industrial wastes and their treatment in the 1950 *Journal* exceeded that in 1949 by about 40 per cent.

The Board of Control recognized the difficulties that have been experienced in the procurement of chlorine where needed for sewage disinfection. There have been several instances in the last year or two where vital chlorination has been interrupted because of the failure of suppliers to deliver chlorine. A special committee was appointed to try to improve the relation between chlorine producers and consumers to avoid continuance or recurrence of this situation.

The Board also considered the matter of material priorities for the construction and operation of water pollution abatement facilities, and by resolution called the government's attention to the need for high priority ratings for the requirements of water conservation to fulfill the needs of industrial requirements and to maintain a satisfactory rate of construction of waste treatment works.

A resolution was passed and sent to governmental personnel concerned recommending that professional sanitary engineers be declared in a critical category of skill, and that a competent authority be created to regulate their allocation to military and civilian services of greatest need if a national emergency arises.

One application for membership in the Federation was presented for a German association. Admission to the Federation was completed by clearance granted by the U. S. State Department and the Department of Defense.

During the year, the Federation's views were given to the Engineers Joint Council on the Report entitled "A Statement of Desirable Policy with Respect to the Conservation, Development, and Use of the National Water Resources." Nine task committees were set up including the fields of domestic and industrial water supply and pollution. The report states that since water supplies are of such prime importance, it necessarily follows that pollution of water resources must be so controlled as to make it practicable to provide a water of satisfactory quality as well as adequate in quantity.

Water pollution should be regulated at the lowest Governmental level adequate for the situation. Usually these will be wholly local, while some will be at the State level and some at the State compact level. Federal jurisdiction and participation should be limited to the administration of the existing laws, to research investigation and guidance.

Boise, Idaho—Two 100 hp. Climax Sewage Gas Engines Direct connected to Worthington Pumps

Stream Pollution

The magnitude of the problem of stream pollution was revealed by data released by the U. S. Public Health Service. A nationwide survey indicates that during the past fifteen years the rapid growth of cities and industries has resulted in an alarming increase in stream pollution. There are 20,000 sources of pollution in the country about equally divided between domestic and industrial wastes. The sewage of about 25,000,000 persons goes into public waterways without treatment and wastes produced by a

Photo by Chicago Aerial Survey Co.

Chicago, Ill.—West-Southwest Sewage Works—Now 900 mgd. including 24 new Dorr Clarifiers

fraction of the industries is equivalent to more than 40 million persons. It is estimated that it will take 10 years and an expenditure of more than 8 billion dollars to construct the treatment facilities needed to cope with the pollution.

During 1950, federal, state, and local groups were active in planning and promoting control of pollution. The six non-government members of the Water Pollution Control Advisory Board were reappointed for another year by the President. The House Appropriations Committee included funds for a national water pollution laboratory in Cincinnati, Ohio. The Advance Planning Program of non-federal public works made almost 7 million dollars available for plans and engineering studies for 394 projects dealing with sewage facilities. The estimated cost of the projects is about 257 million dollars. Several states reported progress on pollution abatement. These include New York State, Florida, Pennsylvania, Connecticut, Kentucky, Maryland and others.

The Ohio River Valley Water Sanitation Commission reported that only 11 per cent of the cities with populations over 5000 had taken no action toward installation of sewage treatment facilities. The Supreme Court of Appeals of West Virginia held that ratification and enactment into law of the Ohio River Compact was unconstitutional. The U. S. Supreme Court is expected to review the decision in the near future.

The Illinois legislature gave the Sanitary Water Board power to adopt and enforce rules and regulations, (1) for the submission of data relative to changes or extensions in sewerage systems, (2) for the submission of operating reports, and (3) for setting up qualifications and requiring the certification of the technical competency of operation personnel of sewage systems.

The Interstate Commission on the Potomac River Basin set up water quality criteria for classifying streams in the basin.

The evaluation of stream pollution by various techniques was covered by several authors, to wit: The importance of correct sampling was stressed by Velz who stated that the statistical approach to sampling affords a maximum of information with a minimum of cost in time and funds. Modification of a pressure cooker for use as a stream sampler was suggested by Hyde. Wolman discussed the use of bacterial standards for natural waters and raised the question of whether or not the suggested limits have any validity. The evaluation of stream conditions by aquatic organisms was discussed by Patrick. Sanderson described the operation of a field laboratory unit used for water pollution surveys.

Pollution abatement continued at an accelerated pace as evidenced by the large number of treatment plants under construction. New York City awarded contracts totalling more than $32 million for construction of sewage disposal facilities. Construction was started on the $25 million Hunts Point Sewage Treatment Plant, which will use modified aeration. Contracts totalling $6 million were awarded for structures and equipment for the Owl's Head Treatment Plant which is expected to cost about $22 million. This plant will also employ modified aeration.

The Special Committee on Pollution Abatements of the New York Legislature reported that 300 New York State communities need sewers

Philadelphia, Pa.—Four Roots-Connersville Air Blowers
(Three rotary positive, one multistage centrifugal)

Whittier, Calif.—Grease Flotation-Aerator Unit—Amer. Well Works

and/or sewage treatment plants. After four years of study the International Joint Commission on Boundary Waters presented its findings and recommendations in reference to the St. Mary's River, the Detroit-Windsor area, and the Niagara River. It urged an enforced clean-up, and immediate action on construction of primary treatment and disinfection for all municipal wastes, 20 per cent of which are now untreated. Domestic sewage totals 750 mgd. and industrial waste 2 billion gal. per day. Estimated cost of the cleanup is $125,000,000.

Tolles reported on the sewage disposal program for metropolitan Cincinnati. Other communities planning or building waste treatment plants which were mentioned in the literature this past year include Toledo, Ohio; Cleveland, Ohio; Miami, Fla.; Wilmington, Del.; Boston, Mass.; Allegheny County, Penna.; Schenectady, N.Y.; Mishawaka, Ind.; Rushville, Ind.; and Tucson, Ariz.

Sewage Treatment

Design and Operation

In March, 1950, Cohn published a list of plants under construction during the previous year. The 665 sewage plants and 284 industrial waste plants under construction are listed according to states and include the location, type of plant, population served and approximate cost.

The design and operation of waste treatment plants furnished subject matter for many papers appearing in the literature of the past year. Typical were the following: Jenks described the Castroville Sanitation District Plant of Monterey County, Calif., which was built on a single longitudinal axis. This design, called "straight eight" effected a saving on the cost of land, conserved pipework, and gave a pleasing appearance.

At Waterbury, Conn., where the sewage contains 122 ppm. of copper and 80 ppm. of chromium, a plant was designed which consists of sedimentation, vacuum filtration, drying and incineration. In a study of sludge force mains, Wolf reports that at velocities of 7.0 ft. per sec., head loss for sludge is close to that of water, while at lower velocities (3.0 ft. per second) the head loss for sludge is about double that of water.

Installation of sludge gas engines continued during 1950. Columbus, Ohio, is installing a 1440 hp, 8 cylinder, supercharged, dual fuel diesel-sludge gas engine. At the Los Angeles Hyperion Beach Plant, nine supercharged dual fuel engines are being installed and the Nassau County, N.Y., Sewage Plant will have five supercharged dual fuel engines totaling 2925 hp.

The selection of gas engines has been discussed by Polakov and by Hayes. Gas availability, dual fuel engines, two- versus four-cycle engines, and supercharging were all considered in the discussions. There are many advantages of spherical pressure vessels for sludge gas storage over low pressure holders according to Wissmiller.

Disposal of garbage with sewage made the headlines in February, 1950,

Bridgeport, Conn.—Discharge End of New Type Link-Belt Grit Washer (left) and Gruendler Screenings Shredder with L-B Screen (right)

when the town of Jasper, Ind., decided to discontinue garbage collection and substitute household garbage grinders. Under the Jasper plan, each individual householder will buy his disposer from the city. At Saginaw, Mich., it was decided to filter wet green garbage at the sewage treatment plant and incinerate it at an estimated cost of $1.00 per ton. Design features for dual disposal have been considered by Cosens, who estimates an increase of 75 percent in primary sludge. To keep eggshells moving requires a velocity of 0.7 foot per second in an eight inch clay sewer pipe, 1.0 foot per second in a six inch and 1.4 feet per second in a four inch pipe.

A Sub-committee of the Advisory Engineering Council of the National Board of Fire Underwriters has prepared a brochure which lists the cause and effect of explosions occurring in sewers and at sewage treatment plants. Sewers laid with insufficient grade, and gasoline and volatile solvents reaching the sewer system cause many explosions and city gas mains close to sanitary sewers often cause serious trouble. The brochure gives 18 recommendations for reducing the probability of explosions in sewers and treatment plants.

In the design of lagoons for treating sewage, the value of 65 pounds B.O.D. per acre per day should be used if it is desired to obtain a satisfactory effluent, according to Parker, Jones and Taylor in Australia. Two stage lagoons, anaerobic and aerobic, give best results.

A series of articles on the design of sewage works based upon regulations or recommendations of the Health Departments of various states was presented by Rice. These papers include collection systems, pumping stations, primary treatment, settling tanks, sludge treatment, disinfection, secondary treatment, trickling filters, intermittent sand filters, final settling and chemical precipitation. Van Kleeck presented an excellent series of articles with practical information on sewage works design and operation.

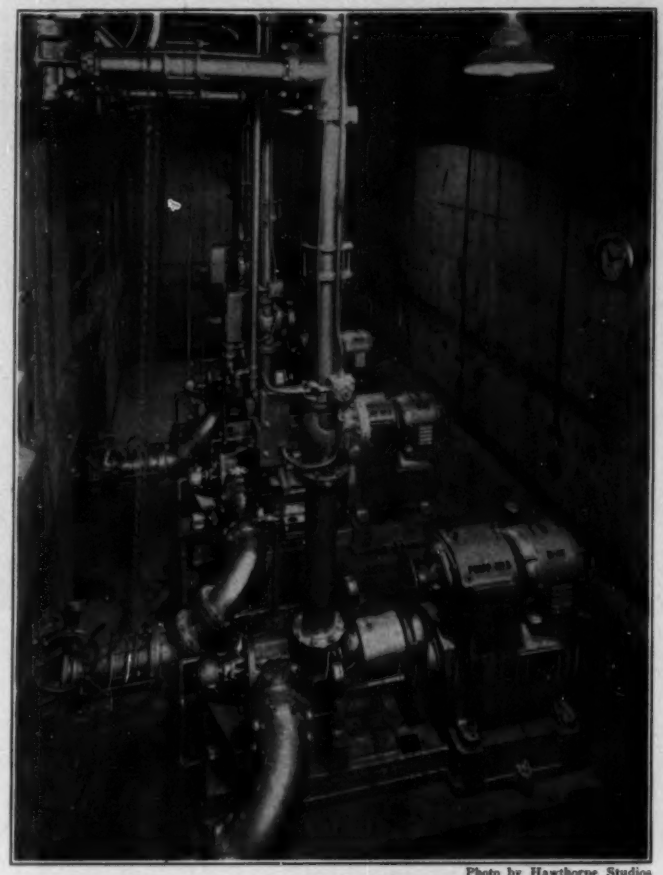
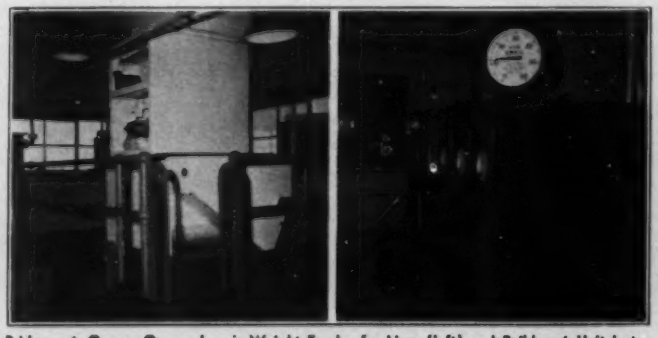


Photo by Hawthorne Studios

Los Angeles, Calif.—Three Screw-Feller Sludge Pumps—Chicago Pump Co.
(One of four such stations. Each pump driven by Reeves Variable Speed Drive)



Bridgeport, Conn.—Omega Loss-in-Weight Feeder for Lime (left) and Builders 6 Unit Instrument Panel (right)

Financing

The financing of sewage treatment facilities was reviewed during 1950. In the U. S., organizing for treatment works can be done by (1) a single municipal corporation, (2) municipal corporations for metropolitan areas referred to as Districts or Authorities, and (3) by private companies, according to Greeley. He summarizes present financing methods as (1) General obligation bonds serviced by assessment on property taxes, (2) Frontage or special assessment bonds serviced by assessment on property benefited by the construction along its front of a water main or a sewer, and (3) Revenue bonds serviced by charges based on rates related generally to use. These methods apply primarily to the construction of facilities while operating funds as provided mainly by levying a tax on property or by charges to users.

New York City—Ward's Island Plant—78 in. Main Diameter Elliptical Venturi Tube—Simplex Valve & Meter Co.

The city of Philadelphia, Pa., expects to have three treatment plants each with a capacity of about 125 mgd. in operation by the end of 1953. This program was made possible by the enactment of a bill authorizing sewer rental charges. At the N.Y. Sew. & Ind. Wastes Assn. meeting the sewer rental system of a large and small city was reviewed. These were the Buffalo Sewer Authority (Buffalo, N.Y.) and Bath, N.Y.

The rental charges at Bath furnish only about half the funds needed to meet operating expenses and at present the deficit is made up from the Gas Department income.

Many municipalities do not have sufficient debt margin to construct treatment plants. In New York State, an amendment was approved by the 1950 legislature which exempts cities from their debt limits up to 75 percent of the cost of sewer systems and sewage treatment works, if through the use of sewer rentals or similar devices, they can be shown in the blueprint stage to be self-sustaining. This amendment must be ratified by the legislators in 1951 and by the electorate at the November, 1951, elections.

Trickling Filters

The 1950 literature contains papers dealing with varied aspects of trickling filter operation and design. According to Thoman, more than 34 per cent of the standard rate trickling filters do not have final settling tanks. These plants represent 18 per cent of the secondary treatment plants in the United States. The practice of not using final tanks predominates in the West South Central group of states.

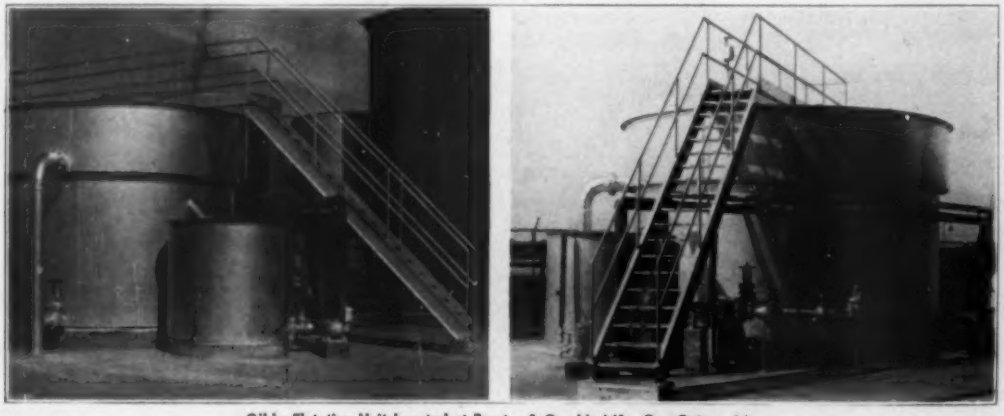
Studies at the University of Florida indicated that it may be of economic advantage to construct filters 4 feet instead of 6 feet deep for use in southern areas.

The use of trickling filters for treating industrial wastes has been extended to include formaldehyde wastes. Oklahoma City sewage with packing house wastes has suspended solids of 500 ppm. and BOD of 375 ppm. This strong sewage is to be treated on a high rate filter followed by a low rate filter.

Filter flies are controlled by dosing a 90 foot filter with 4 gal. of 5 per cent DDT at Hayes, Kans. Recirculation equal to 95 per cent of the sewage flow raised the over-all efficiency of the Centralia, Mo. plant from 85 to 93 per cent in a study reported by members of the U. S. Public Health Service. Cutting down areas of the trickling filter during low night flow in order to insure maximum oxygen absorption at full spray was reported by Anderson in a study of oxygen absorption by trickling filter spray.

Activated Sludge

With reference to activated sludge, most of the papers dealt with air diffusion. The Chicago Sanitary District will use fixed plate diffusers in the additions to the West-South West plant. The plates will have a perme-

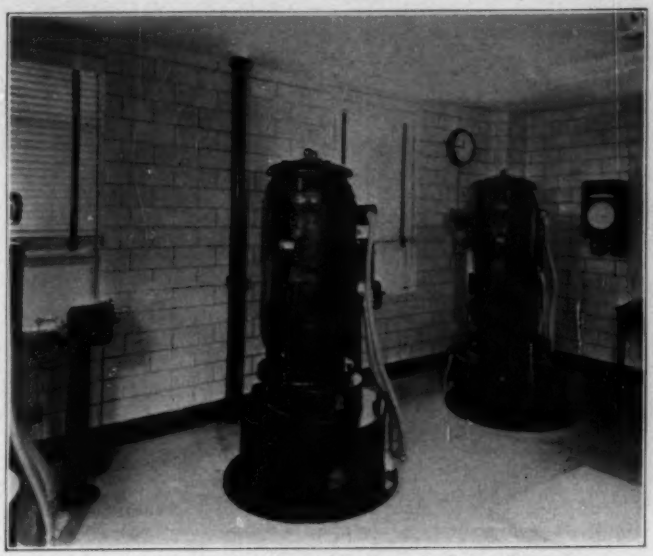


Gibbs Flotation Unit Located at Procter & Gamble Mfg. Co., Quincy, Mass.

ability rating of 80 with the exception of one tank, where the permeability rating is to be 120. The plates will be cemented into 6-plate precast concrete holders. Bag filters and electronic secondary filters are expected to reduce dust in the air to 0.5 mg. per 1000 cu. ft. There will be a 27 per cent greater concentration of diffuser plates in the influent half of the tanks than in the effluent half, in order to obtain a uniform life or rate of clogging throughout each tank.

At the Wards Island plant diffuser plates are cleaned with an oxy-acetylene flame. At Johannesburg, South Africa, where mineral oil was clogging the diffuser plates, a hot air oven was constructed to distill off the oil and restore the plates to a satisfactory condition. Experience at Columbus, Ohio with saran-wrapped tubes for air diffusion showed that sand with organic matter will plug the diffusers. The tubes were cleaned by soaking for 12 hours in a 3 per cent solution of sodium silicate plus a non-ionic detergent after which the tubes were passed through a high-pressure water jet. It is estimated that the tubes should be cleaned every two or three years at a cost estimated to be about one-twelfth that of cleaning plates.

The oxidizing capacity of activated sludge was the subject of several papers. At Baltimore, it was found that preaerating a sludge enhanced its ability to oxidize sewage and it is suggested that it may be more economical to preaerate the activated sludge in separate tanks before it is added to sewage. This is a return to the old re-aeration tank, which was more or less abandoned because it was difficult if not impossible to get oxygen into solution fast enough to satisfy the demand of a concentrated activated sludge. However, if cheap oxygen were to reach the market, this limitation might be overcome.



Stratford, Conn.—Gen. Electric Gear Motors for Sewage Pumps
(At left is Healy-Ruff Float control)

Finch and Ives have reviewed the subject of sludge index and concluded that the present measures of sludge index suffer from the effect of consolidation and the time factor. By using a "Sludge Settleability Index" based on a 6-minute period of settlement in place of 30 minutes, they exclude the consolidation phase, but not the time factor. A rapid indication of change in sludge quality can be obtained from the slope of the sludge settlement curve, if the suspended solids content remains reasonably constant.

Sludge Treatment and Disposal

Sludge digestion from the operator's viewpoint was presented by Haseltine, who states that digestion odors may be practically eliminated by maintaining a high alkalinity and a thoroughly digested sludge in open tanks and by avoiding sudden changes in loadings and temperatures. Circulation of sludge or supernatant from lower parts of the tank onto the scum can be used for scum control. A logical treatment of "bad" supernatant overflow liquor would be settlement in

Madison, Wis.—Nine Springs Sewage Plant—Rex Tow-Bro Sludge Collector—Chain Belt Co.

Kirkwood, Mo.—Impingement Aerators for Activated Sludge—Walker Process Equip. Co.

a separate tank. Foaming can best be controlled by giving digestion time to catch up with the digestible material by reducing or discontinuing the dose of raw sludge. At the Caro State Hospital in Michigan, a heavy scum cap could not be handled by recirculation of supernatant since the large chunks which broke loose caused pump clogging troubles. It was necessary to add about 6 volumes of water to thin the sludge enough to pump it from the tank. Recirculating for two hours each day prevented the formation of another heavy scum cap.

With the increased costs for conditioning chemicals, elutriation becomes more valuable. At the Richmond-Sunset Plant, San Francisco, it was concluded that elutriation is a very valuable and necessary part of the plant treatment process. It has produced a uniform sludge with reduced coagulant demands; it has been used to remove suspended solids from digester overflow; and it has increased the flexibility of operation of the two stage digestion system.

Zack concluded that for sludge dewatering and disposal the combination that permits drying or incineration offers the answer which meets many situations, that dewatering of undigested sludge is not entirely satisfactory since the putrescible organic matter still remains, that lagooning of sludge is only a stop gap method, that disposal at sea might be handicapped by future restrictions, that mechanical dewatering, drying and incineration is limited economically to the larger cities and that smaller municipalities can best be served by digestion and drying beds. Mechanical dewatering and burning sludge with garbage and refuse extends the method to smaller municipalities.

Mick described the Minneapolis-St. Paul filter washing operation which has proven of value in increasing the filter yields. At Greenwich, Conn., the Park Department uses about 90 per cent of the dried sludge for growing grass, trees and making compost. A comparison of underdrained sand beds and lagoon type field beds at the Los Angeles County Sanitation District showed that for digested sludge the cost was about five times greater for the underdrained sand beds.

The cleaning of sand beds with tractor-loaders was the subject of several papers. The mechanical cleaning is a great improvement over the manual method and no harmful effects on sand or underdrains by 10 in. caterpillar tracks were noted.

Interest was shown in sludge disposal by composting. At Austin, Texas, digested sludge on sand beds is treated with pine sawdust and worked up into a composting material. Where sludge and garbage are treated together, the material is usually given natural ventilation by limiting the size of the mass. At Baden-Baden, Ger., digested sludge dewatered on sand beds will be mixed with ground and assorted garbage. The sludge-garbage mixture will undergo aerobic fermentation. The compost will be sold and the sludge gas from the sludge digesters will be processed for motor fuel. It is expected that the revenues from the sale of compost and fuel will more than pay fixed and operating charges of the plant because the sludge gas has a much higher retail value in Germany.

Chlorination

In a statistical summary of sewage chlorination practice in the U. S. it was revealed that 1307 plants, serving 18,000,000 persons, disinfected sewage by means of chlorine or one of its compounds. Thoman has prepared a table showing the distribution of the plants using chlorination by states and indicates whether chlorination is by (1) hypochlorite, (2) hypochlorite and contact tank (3) liquid chlorine, or (4) liquid chlorine and contact tank. Comparative data for the past decade showed no general increase

Shallow Lagoon for Sludge Drying—Los Angeles County
("Field Bed" emptied, graded, ready to refill)

in the frequency of chlorination practice.

In subresidual chlorination of sewage, as the chlorine dose is increased the disinfecting action falls off or vanishes at certain dosages according to Beardsley. He suggests that critical points may correspond to the initiation or completion of specific reactions, or to the attainment of critical levels of oxidation potential. Sewage contains many substances capable of forming bactericidal products on chlorination which may be destroyed as more chlorine is added. The effectiveness of partial chlorination depends primarily on the substances present in the particular effluent.

Nagano studied the oxidation of sulfide by chlorine and concluded that sulfate is formed and that the ratio of chlorine equivalent to sulfide is 8.87 to 1. A specially designed utility truck for distributing one ton chlorine containers was described by Miller.

In a study at the University of Washington on chlorination of raw and digested sludge, it was concluded that it is simpler to prechlorinate the sewage rather than to chlorinate the sludge removed from primary settling tanks.

Septic Tanks

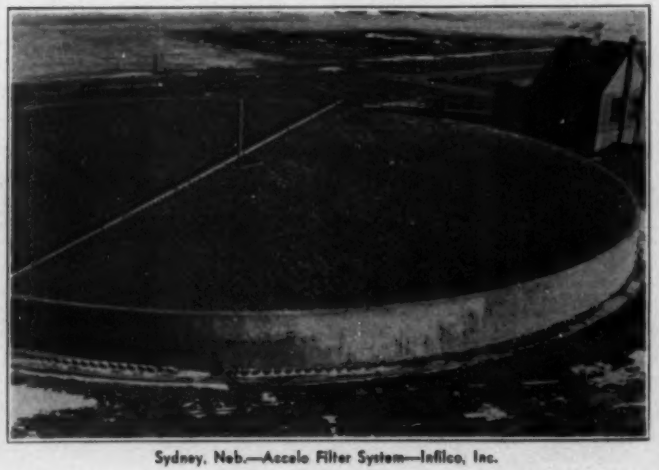
Inasmuch as about 17,000,000 Americans depend upon septic tanks with subsoil absorption for sewage disposal, the Public Health Service has conducted a survey of practices followed when building individual household septic tanks with the hope of developing design and performance standards. A report from this agency indicates that best overall performance is obtained from two compartment tanks and that the percolation rate of soils is adversely effected by including garbage and disinfectants in the sewage.

Ludwig reported that an elongated tank performed better than the standard tank and believes that a length-width ratio as high as 20:1 is satisfactory and that it should be possible to decrease the depth to about 30 inches and get satisfactory operation.

Percolation tests as the basis of design for sewage absorption fields was discussed by Kiker who proposed the formula, $C = \frac{(t + 6.24)}{29}$ where C = gpd. per sq. ft. and t = the standard percolation time in minutes per inch. A new type of fabricated steel septic tank expected to sell for about $50 was described by Hendon.

Colloidair Separator for Removing Oil from Tank Car

(Wash Water Tank car washing facility in background, waste water with 400-500 ppm. of oil in foreground)



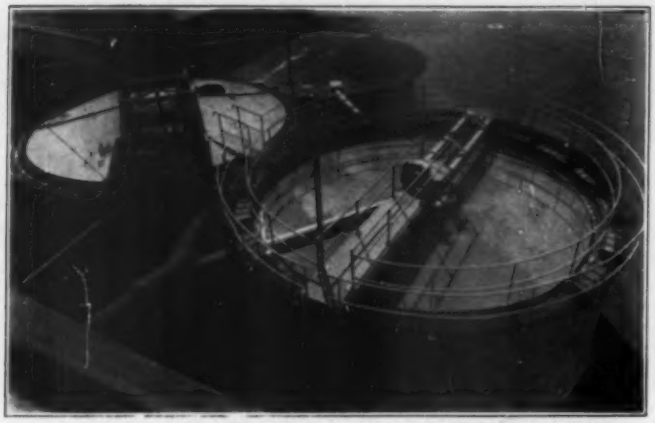
Sydney, Neb.—Accelo Filter System—Infilco, Inc.

Industrial Wastes

The widespread interest in the industrial waste problem is evident from a glance at the 1950 literature. Industrial Waste Conferences and Forums on the subject are increasing. In addition to the annual conference held at Purdue University, a three-day New England Industrial Waste Conference was held at M.I.T. in June. The American Chemical Society published a symposium on industrial wastes in April and many of the sewage associations included the topic on meeting programs. In May, 1950, representatives of 22 of the Nation's leading industries met and established a National Technical Task Committee on Industrial Wastes.

The industrial waste problem is being studied by varied groups, and the wide interest was shown by the federal industrial pollution studies as discussed by Black, and studies and research projects underway by industrial associations as reported by Ehlers who pointed out that many of the large industries are undertaking their own pollution abatement programs, not depending entirely upon their industry association for guidance. Wisely's discussion of industrial-municipal cooperation in the disposal of industrial wastes likewise emphasized the importance of the industrial waste problem.

Undesirable effects of industrial wastes on municipal plants and fish life have been reviewed. Eldridge grouped industrial wastes into 6



Schmidt and Ault Paper Co., York, Pa.—30 ft. dia. thickener—Hardinge Co.
(For recovery of fiber and filler from "white water" for reuse—Note older thickener in background)

classes on the basis of their effect on sewage works. These are: (1) Those affecting volumetric load, (2) Those which deposit materials that interfere with flow, pumping, measurement, etc., (3) Those which have destructive action on structure or equipment, (4) Those which increase solids loads on primary treatment units, (5) Those which increase the organic or B.O.D. load on both primary and secondary units, and (6) Those which have a toxic or inhibiting effect on the biological processes.

For the correction of industrial waste effects on sewage systems, it is suggested that municipalities:

1. Require segregation of all clean water, with separate discharge, if possible.
2. Require waste prevention measures in all industries.
3. Require grit removal at the industry.
4. Prohibit dumping of oil to the system.
5. Require neutralization of acids and alkalies to pH 5.5 to 9.5.
6. Prohibit discharge of toxic material to the sewers in destructive or inhibiting amounts.

At Topeka, Kansas, where packinghouse and creamery wastes have placed a heavy B.O.D. load on the treatment plant, severe foaming has been experienced. It is hoped that a change from "one point feeding to feeding in all three passes" will reduce foaming and increase aerator capacity.

A Sub-committee on Toxicity of the Federation has presented several literature reviews on toxic materials affecting sewage treatment processes, streams, B.O.D. determinations, and the flora and fauna of streams. Data obtained from the literature were tabulated and summarized, information on many substances, compounds, and industrial wastes is not recorded in the literature.

The extent of industrial wastes in the Raritan River Valley for example, is indicated by the fact that industries account for 75 per cent of the wastes on the basis of flow, 61 per cent on the basis of B.O.D., and 68 per cent on the basis of suspended solids according to Rudolfs and Heukelekian.

Other indications of the interest in industrial wastes include the Washington State Pollution Control Commission's list of procedures for prevention and reduction of industrial waste pollution from different industries in its "Minimum Requirements for the Control of Industrial Wastes," and the regulation of industrial wastes entering the Westchester County (N.Y.) sewers as discussed by Harding.

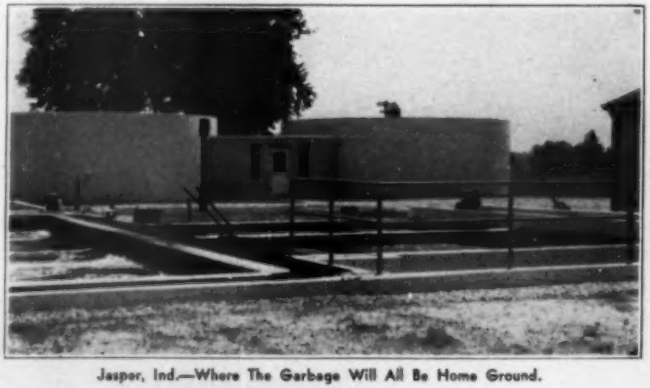
In 1950, many authors discussed the treatment of industrial wastes. Flocculation and sedimentation for wastes by means of the Infilco Accelator and Cyclator was discussed by Koninek.

According to Heukelekian successful biological oxidation of industrial wastes depends primarily upon the chemical composition, physical state, concentration and carbon-nitrogen ratio of the waste used as a food source, the type and number of seeding organisms, and proper environmental factors such as pH, temperature, oxygen supply and absence of toxic materials. At M.I.T. experiments were underway to determine nutritional requirements of activated sludge and trickling filters in the stabilization of several industrial wastes and to correlate nutritional supply with process efficiencies.

High-rate anaerobic digestion of wastes has definite limitations as pointed out by Gehm and Behn, who consider research on the mechanism of this process highly desirable. Testing industrial waste for toxicity and applying standard tests to industrial wastes was discussed. A Public Health Service publication described an apparatus for bioassay of the toxicity of industrial wastes with fish as test animals. Norgaard discussed significant characteristics of wastes and pointed out that there is a tendency to limit observations to the B.O.D. and suspended solids tests which is unwise since other determinations can be quite useful. Ettenger also discussed the selection and application of analyses for evaluation of industrial wastes.

The Water Pollution Control Act of 1948 authorized appropriations for grants to states and interstate agencies for studies of water pollution resulting from industrial wastes. The USPHS announced that grants had been made totalling $995,427.

Among the many individual types of wastes which were reported on during the year were the pulp and paper wastes. Investigations were re-



Jasper, Ind.—Where The Garbage Will All Be Home Ground.

ported on heating of sulfite waste liquor; three stage chemical treatment of cooking liquors; strawboard wastes, mechanical dewatering of paper mill sludges; treatment of sulfite waste liquors by biological methods; and the use of sodium nitrate to control H_2S formation in a stream receiving sulfite wastes. The problem of finding markets for potential by-products of waste treatment is a serious consideration in any treatment process selection.

Food processing and dairy wastes received considerable attention, with the latter forming the particular interest of a Joint Task Committee on Dairy Waste Disposal. Wastes from poultry packing plants were treated by sedimentation, while canning wastes treatment by aeration ponds consisting of hydraulic jumps was recommended. Lagoons were reported practical for the treatment of cannery and slaughter house wastes, and laboratory studies indicated that tannery waste sludge could be digested satisfactorily with domestic sewage sludge. Chlorination of beet sugar waste water permits its reuse and results in the recovery of more sugar.

In the chemical waste field, the Manufacturing Chemists Assn. has a Steam Pollution Abatement Committee to assist member companies in problems of waste treatment. The Textile Foundation, Inc., has sponsored studies on mill wastes common to the industry.

Among the several innovations introduced were the Gibbs Flotation Unit, first used on soap wastes, and the "Colloidair Separator" for removing oil from the Santa Fe Railroad wastes at Los Angeles.

Reports of successful waste treatment installations included those for dye wastes (by tickling filter), cotton finishing wastes, carpet mill wastes, phenol wastes (by recovery) brewery wastes, distillery wastes, compressed yeast wastes, etc.

In the electroplating field, the disposal of spent pickle liquor, cyanides, and chromium salts received the most attention. Hoak has described a new neutralization technique which is said to solve the problem of sludge disposal where limited or no lagoon space is available. Controlled oxidation of part of the iron by air in the presence of an alkali produces ferroso ferric oxide, which forms a rapid settling slurry that compacts to a small volume and can be filtered at a high rate on a vacuum filter.

The treatment of cyanide waste by chlorination with final settling has been reported. Chlorine dosages recommended range from 3 parts of chlorine to 10 parts of chlorine for each part of cyanide.

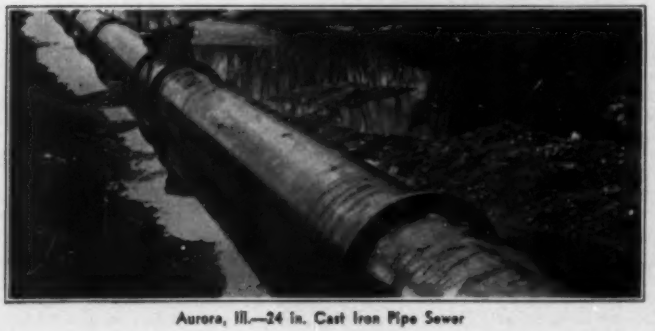
Removal of chromium by ion exchange was discussed by Bloodgood who stated no satisfactory method was available for regenerating the resin used. It was reported by members of the Illinois State Water Survey that the sludge digestion process was not adversely affected by doses of less than 10 ppm. of trivalent chromium; higher doses interfered with the process.

Hampton Roads San. Dist., Norfolk, Va. Two Wallace & Tiernan Master Visible Vacuum Chlorinators

(Note Ton containers and Fairbanks Morse Scale through window)

At the 118th National Meeting of the American Chemical Society held in September at Chicago, Ill. about one half of the program of the Division of Water, Sewage and Sanitation Chemistry was devoted to a symposium on *radioactive wastes* problems and treatment. Papers dealt primarily with the measurement of radioactivity and the treatment of radioactive wastes.

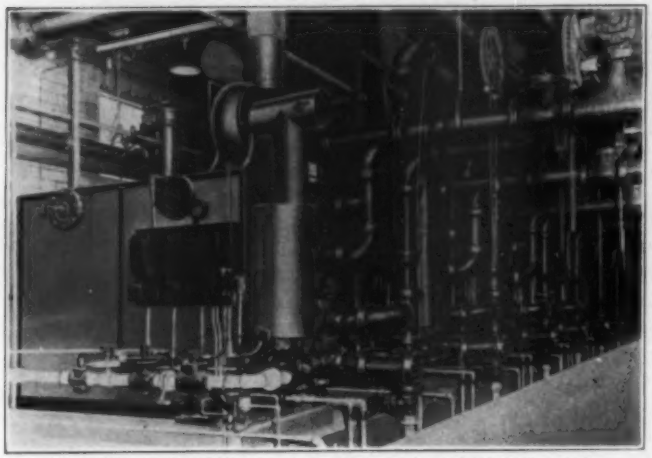
Included in the topics covered were plant problems imposed by radioactive wastes, handling radioactive wastes in sewers, dilution of radioisotypes with the stable form of the same element, concentration of the wastes, and limits of tolerance. At Atomic Energy Commission Report on Handling Radioactive Wastes in the Atomic Energy Program is obtainable from the Government Printing Office at the cost of 25 cents.



Aurora, Ill.—24 in. Cast Iron Pipe Sewer

Research

Statistical methods, long a useful tool in other phases of public health work, are finding wider application in the sewage treatment field. Fertig and Heller discussed the application of statistical techniques to sewage treatment processes. By statistical procedures Eliason and Kriger have developed a method whereby it is possible to correlate the chlorine dosage with the M.P.N. of coliform bacteria remaining in treated sewage. In a series of articles, Velz presented



Akron, Ohio—Eight PFT Heater and Heat Exchange Units, 8,000,000 Btu per hr.
(For 6—895,000 cu.ft. digesters and 2—145,000 cu.ft. digesters)

graphical techniques readily applicable to sanitary engineering. One of the purposes of this series is to encourage the use of statistical methods. Bushee has discussed several mathematical expressions relating to sewage treatment processes.

Interest in the B.O.D. test continued. In a comparison of the B.O.D. test with the chemical oxygen demand test by Ingols, Hildebrand, and Ridenour it was concluded that much more can be learned about the sewage or industrial waste sample from a careful comparison of the C.O.D. and B.O.D. values than can be learned from either test alone. Commenting on the B.O.D. versus chemical oxygen demand, Rhame pointed out that the two tests do not measure the same thing. The C.O.D. test is more rapid and, therefore, of more value for plant control, but should be compared on the basis of total first stage demand.

The use of physical and chemical means of suppressing the second stage B.O.D. was studied at the Sanitary District of Chicago. A study of the nitrification phase of the B.O.D. test at the Illinois State Water Survey indicated that the incidence of nitrite formation is due in part to the long generation time and to the variability of the inoculated substrate with respect to the numbers and metabolic activity of nitrifying organisms. At M.I.T. it was found that glucose or glutamic acid solutions (300 ppm.) can serve as primary standard solutions in B.O.D. work. Thomas presented a graphical method for determining B.O.D. curve constants which gives results which are reasonably close to those obtained by much more elaborate methods.

Studies on the survival of microorganisms was reported by various workers. Rudolfs and others have presented a literature review on the occurrence and survival of enteric pathogenic and relative organisms in soil, water, sewage, and sludges. It is reassuring to note that they report the impression that Esch. coli is more resistant than E. typhosa in sewage and water. Fuller and Sitsky reported that the absence of E. Coli from dried sludge should be adequate insurance against danger from pathogenic intestinal types of bacteria. Pramer and Heukelekian reported that tubercle bacilli can be removed from sewage by a combination of chemical coagulations, sand filtration, and chlorination to 1.0 ppm. *free* chlorine residual.

In a series of articles, Eckenfelder and Hood pointed out that the alkalinity of the sewage changes with biological treatment and is associated with treatment results. Under certain conditions the alkalinity determination can be used as a measure of oxidation efficiency in the activated sludge process.

The measurement of sewage flows by weirs and Parshall flumes was reviewed by Stancati. Davy studied the influence of velocity in sewers on sulfide generation and concluded that conditions necessary for no buildup of sulfides in sewage flow during dry weather can be approximately stated in terms of the Reynolds number, B.O.D., temperature, and geometry of the sewage cross-section.

During the year it was announced that a method for removing phosphorous from effluents has been developed at the University of Wisconsin. Concerning synthetic detergents, Hurley stated that "Teepol" had no effect on any stage of the treatment process and that no modifications of present methods will be necessary. Laigret stated that an anaerobe B. perfringens can produce not only methane, but also petroleum from soap.

In a study of short course training in the U. S., Ingram found that during 1948 over 2,000 persons were trained by 18 statewide schools, 9 regional type schools, one state localized type school, and one university extension correspondence course.

Chlorophyll deodorizers have been developed for use at the San Francisco sewage treatment plant. By saturating 300-400 cfm. with "Nu-Air" fluid about 3500 cfm. of foul air can be effectively deodorized. It was announced that negotiations are under way between the Edison Company and the officials of the Los Angeles Sanitation District for permission to withdraw up to 8 mgd. of raw sewage from the District's sewers. A treatment plant will be constructed and the effluent processed for use in a steam generating electric plant. The Daytona Beach Process which utilizes calcium carbonate sludge from a water softening plant, was found to give better results with some diffused air. Operating results of the Daytona Beach Plant showed that over 60 per cent of the B.O.D. could be removed.

Radioactive isotopes have several advantages over salts and dyes for studying the mixing of sewage flows. Thomas and Archibald cited the small concentrations required to observe flow patterns. The tracers can be detected through pipes and the withdrawal of samples is eliminated in certain studies. Modern Geiger counters can be used to detect the radioactive tracers.

Construction and Equipment

The use of synthetic resins and aluminum alloys in the waste treatment field is increasing. Kasser re-

Macclenny, Fla.—Seven Miles of "Transite" Sewer Has Little Infiltration

ported that aluminum alloys have a high resistance to corrosion caused by substances usually found in sewage. The usual concentration of organic acid, hydrogen sulfide, and ammonia are not seriously corrosive to aluminum alloys. Aluminum manhole steps in three sizes, adaptable to concrete, brick, or concrete block wall construction were marketed by the Aluminum Co. of America. The non-sparking characteristic of aluminum is particularly advantageous where explosive gases or dust may be present.

Munger described the use of a vinyl resin liner for correcting corrosion under conditions where the conventional tile linings failed. Saran lined steel pipe and saran lined valves supplied by the Dow Chemical Co. are available for handling corrosive fluids and gases.

Threaded plastic pipe and molded plastic fittings was announced by Carlon Products Corp. The International Nickel Co. has developed a cast iron which can be bent or twisted and the material is claimed to possess outstanding strength and ductility plus resistance to shock. It is expected to find widespread use in industry. Permanite pipe and duct work is available from the Maurice A. Knight Co. of Akron, Ohio. This material is resistant to all non-oxidizing acids, alkalies, organic solvents, thermal shock and temperatures to 280° F.

The joining of clay sewer pipe was proposed by Rosenthal who recommends Clay Pipe Compound or CPI-2. The first is composed of coumarone resin, a plasticizer, and powdered silica; the second is a coal tar product that melts and pours readily at 350° F. Experience with asbestos-cement pipe sewers at Macclenny, Fla., was very satisfactory and practically eliminated infiltration.

Several new type pumps have been described in the literature. Fairbanks, Morse Co. brought out a bladeless sewage and trash pump which is from ten to twenty-five times as "non-clog" as a conventional pump.

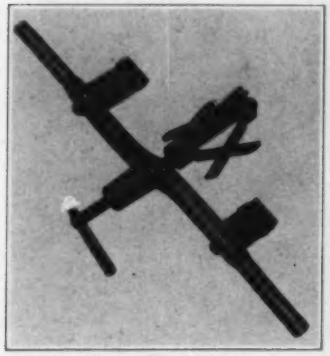
Close control of pumping can be achieved by magnetically driven pumps actuated by a float controlled "Regutron". Philadelphia, Pa., is installing four of these units, manufactured by Electric Machinery Manufacturing Co. for use in storm water pumping station. A new line of vertical turbine pumps has been developed by Worthington Pump & Machinery Corp. in sizes ranging from 50 to 150 gpm.

A new type pipe testing machine of 200,000 lbs. capacity has been installed for testing sewer pipe and structural materials used by the Borough of Queens, N. Y. C. All driving mechanism is carried on the crosshead and the conventional pit under the machine is eliminated. A new type air meter was described by Haggerty. Flexibility to meet changing conditions is one of its outstanding characteristics and it can be used on gas, air, sewage or sludge.

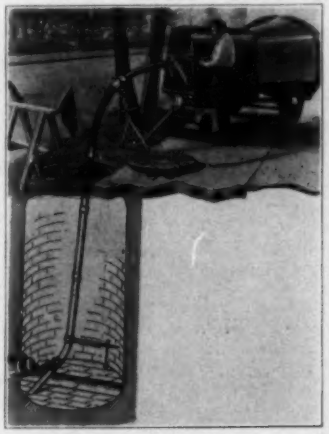
A new Ferro-Feeder especially for ferric chloride solution or other corrosive liquids was marketed by Proportioneers, Inc. Fischer and Porter Co. of Hatboro, Penn., marketed a "Rate-Chlor" chlorine dispenser. Builders-Providence introduced a new high capacity volumetric chlorinizer. A new low-cast Hi-Pressure Jet Cleaner has been announced by the Sellers Injector Corp.

Among the published articles on equipment were: A review of the Mechanical Equipment used in Sewage Treatment (by Flood); Electrification of Sewage Treatment Processess, (by Greiff and Luft); and Operation and Care of Centrifugal Pumps (by Coleman).

(Persons interested in the original articles or authors referred to in this review may obtain further information by writing the author.)



Machining Tool for Asbestos-Cement Pipe
(Pilot Mfg. Co.)



Flexible "Sewerodor"
(Flexible Sewer-Rod Equip. Co.)

Flexible Sewer Pipe Joints
(Ceramicweld pipe, couplings and fittings by Pacific Clay Products Co.)

B. H. Swab Now in Oklahoma City

Joins Hudgins, Thompson, Ball Consultants

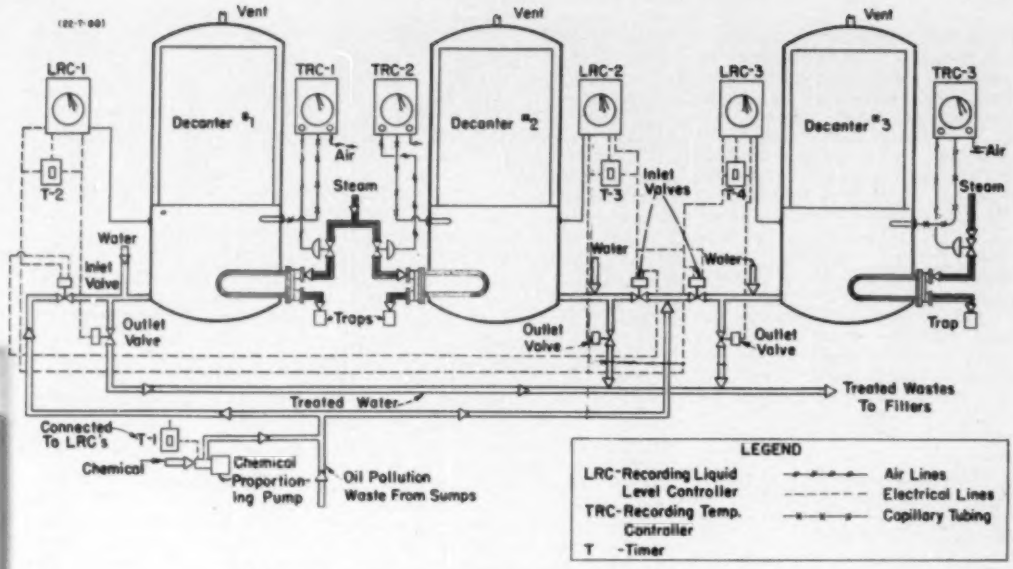
Bernal H. Swab for many years associated with the firm of Jones and Henry, Consulting Engineers of Toledo and lately with Blundon and Snyder in Keyser, W. Va., has joined the firm of Hudgins, Thompson, Ball and Associates, Construction Consultants of Oklahoma City, Okla.

Mr. Swab, whose specialty is water and sewage works is now making the preliminary investigations for a sewage treatment plant for Enid, Okla., where there is a wide diversification of industrial wastes, including two seasonal industries, egg drying, and wheat washing.

Cleanliness No Longer Next To Godliness

Water Shortage the Cause

There will be no housecleaning in Mountville, Pa. this season by order of the Secretary of the Borough Council. It was necessary to issue the order in this town of 1000 because of the serious shortage of water in this Pennsylvania Dutch Community.



Automatically Functioning, Instrument Controlled Waste Treatment Plant

How Instrumentation Facilitates INDUSTRIAL WASTE TREATMENT for Cooper-Bessemer Corp.

by

W. E. OESTERLING, *Ass't Plant Engineer, Cooper-Bessemer Corp., Grove City, Pa.*

THE Cooper-Bessemer Corporation has placed in operation a waste treatment plant to prevent pollution of Wolf Creek, which ultimately combines with other principal streams and rivers in Western Pennsylvania. This was done in the interest of state and national programs to eliminate stream pollution, the public in general, and the citizens of Grove City and surrounding areas, in particular.

In cooperation with the Pennsylvania State Department of Health, various systems to effect the removal of oils from plant waste water were studied and considered. It was found that the most practicable and least expensive method was to pump the oil-polluted water to an instrument-controlled, automatically-operated demulsifying, decanting and filtering plant.

Cooper-Bessemer's Grove City plant is engaged principally in the manufacture of Diesel engines, gas engines, compressors, high-pressure liquid pumps, and the newer gas-Diesel engines, such being especially suitable as power generators operating on digestor gas at sewage treatment plants. In the production, power generation, and performance testing of these mechanisms, large quantities of various oils and greases are used—such as: lubricating oils, fuel oils, cutting oils, and greases for anti-corrosion service. In the day-to-day operations in which these great volumes of oil are used, losses from spillage are unavoidably large. Previous to the present installation of our waste recovery and treatment plant these wastes passed into the sewers and ultimately into Wolf Creek.

Sources of Oil and Grease in Plant Effluents

Enormous quantities of water are used for many purposes—chiefly, however, for engine cooling in the Power House as well as the Diesel Testing and Erection Department. Various water polluting material originates from the following sources:

(1) Lubricating oil and fuel oil spilled on the floor or in pipe ducts of the Diesel Testing and Erection Department.

(2) Spillage of fuel oil at storage tanks through leaks in the line from main storage tanks to auxiliary tanks located below the floor in the Diesel Stores Department and Power House.

(3) Spillage of machine cutting oil in the Crank Shaft Department.

(4) Spillage of lubricating oil and Diesel fuel oil in the Power House.

(5) Lubricating oil in air lines. (Since the air compressors are not equipped with after-coolers, appreciable amounts of lubricating oil are carried out in the distributor lines. Much of this is discharged in the main tunnel under the plant.)

(6) Additional oil condensed with water in excess compressed air which is exhausted into the tunnel.

(7) Dark cutting oil which is frequently dumped into the sewer in the pipe shop.

(8) Grease compounds to prevent rust on castings in the yard area, washed off during rains.

(9) Spillage in Shipping Department of *Nox-Rust*, a dark viscous greasy liquid used to coat small engine parts.

In general, the quantity of grease and oil discharged daily varies in proportion to the flow of cooling water. However, it was concluded by waste disposal specialists and consulting engineers that regardless of what the actual oil content might be, some method of either excluding oil and grease from the sewer, or removing it before it enters the open runs was necessary.

Method of Separation of Oil and Grease from Waste Waters

For removal of oil from the entire waste flow from the plant, facilities had to be of sufficient capacity to handle a flow of over 4,500 gallons per minute. Conventional systems for treating oil water mixtures employ socalled separators and filters, which comprise baskets or frames packed with hay, straw, excelsior or some other similar media to filter the water, retain foreign materials, and absorb the oil present. With this method, however, a saturation point is reached where the effectiveness is reduced or lost, so that the filters must be changed.

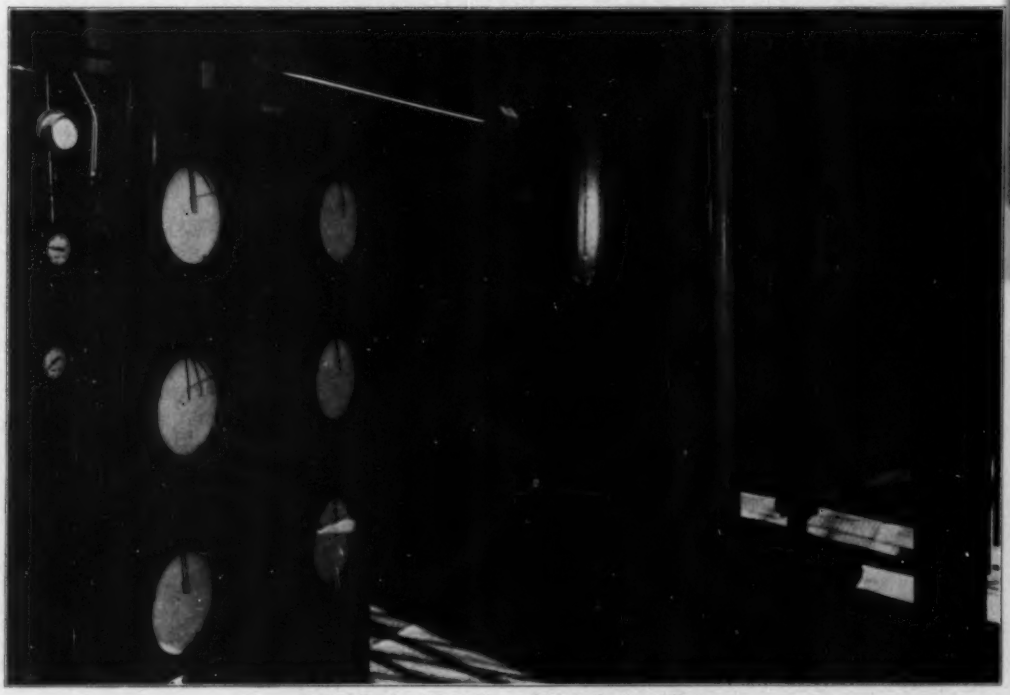
A number of possible arrangements employing these systems have been suggested for removing oil and grease from waste leaving the plant. These necessarily require rather elaborate construction of separators, filters and effluent pumps, or construction of new sewers to handle total flow of storm and dry weather wastes.

Systems of this type, built to rely on gravity alone so as to retain solids and immiscible liquids which differ in specific gravity from water, invariably allow some oil to escape. Furthermore, they must be designed and constructed to preclude high flow velocities and turbulence which might emulsify the oil and water, since conventional separators and hay filters will not remove oil and grease from emulsions. Therefore, an attempt had to be made to *prevent* formation of emulsions by treating the oil-polluted water below the sewer level and pumping the treated clean water back to the sewer or outlet.

Automatically Controlled Demulsifying System Installed

At our Grove City plant, where effluent must flow through a highly developed production area, it was decided for economy reasons to employ a treatment plant of special design which made an attempt to *avoid* emulsion formation. With this system, which is arranged for automatic operation, the oily wastes are led to one of three 8-foot diameter, 19-foot high decanters provided with internal annular baffles and overflow compartments. See accompanying drawing.

As shown in the drawing, each decanter is equipped with an air-purge type liquid level controller (LRC) comprised of a Brown Recording Pressure Gauge, with two elec-



Control Panel and Partial View of Waste Treatment Plant

tric contact (Electr-O-Vane) control units and separately adjustable set-point indices.

One set-point is the liquid level below the rim of the annular baffle. The other is the low level, located so as to preclude discharge of separated oil. The inlet and outlet electric motor-operated valves for each decanter (shown in the accompanying drawing) are operated by the controllers to close or to open for liquid passage in accordance with process cycle requirements.

Since high temperature and certain chemicals implement demulsification, necessary apparatus and reagents are provided to utilize this means of breaking emulsions. Each decanter is equipped with a heat exchanger which receives steam from a boiler to heat the water, and a Brown Recording Thermometer (TRC) with pneumatic control, as shown in the accompanying drawing and photographs, to maintain the proper process temperature. The chemicals are pumped into the waste water by an electric-driven %Proportioneer's% pump, actuated by timers which also time the treatment period.

During treatment, after the decanter has been filled, the oil separates from the water and floats to the top. It is run off and the waste-free water is passed through a filter and on to the sewer.

The Author Taking Instrument Readings
(Cooper-Bessemer Waste Treatment Plant)

Detailed Operation of Treatment Plant

The waste water and oils accumulate in eight concrete sumps located throughout the plant. Centrifugal pumps force out the water from the sumps to a common three-inch header which is connected to the three decanters. The wastes all flow to one of the three treating tanks until it is filled, then to the second, and so on in succession.

The Brown Level Controllers (shown in the drawing and on left-hand side of panel in photograph) are set for high and low level regulation, the chemical proportioning pump and holding period timers are adjusted for the required cycles, and the Brown Recording Thermometers are set to maintain a predetermined process temperature. Selector switches are then manipulated for automatic operation. As the inlet valve on the first decanter opens, oily wastes are introduced into this tank and the proportioning pump is energized so that chemicals are fed into the polluted water. With elapse of the reagent injection period, timer (T-1) (see drawing) shuts off the pump and clean water is flushed into the pump to clean it out.

When the waste solution reaches the predetermined high levl, as recorded by the instrument (LRC-1), the following controller action is initiated. The inlet valve of No. 1 decanter is closed, and timer (T-2) is energized to accurately space the treatment period. Meanwhile, the Brown temperature controller (TRC-1) operates a Honeywell on-off diaphragm motor valve (see drawing) on the steam supply line to No. 1 decanter heat exchanger to maintain the desired set-point.

At the end of the decanting period, timer (T-Z in the drawing) automatically opens the outlet valve and the effluent drains out to a filter bed of finely crushed anthracite coal which retains final traces of oil. After the decanter drains to the low level limit, controller (LRC-1) closes the outlet valve and the decanter is ready for the next charge of waste.

At the same time that the inlet valve of No. 1 decanter is closed and timer (T-2) is energized, the inlet valve of No. 2 decanter is opened, and the proportioning pump is energized to feed demulsification reagent into No. 2 decanter as the oily wastes flow into this tank from the three-inch header. The same sequence of operations described for decanter No. 1 is now repeated in decanters No. 2 and 3 in succession, and the complete cycle is then ready to be repeated.

Built-up Layer of Oil Skimmed Off

The joint action of the reagents and heat break the emulsion. After demulsification oil and greases float to the top. A five-inch layer of oil of about 0.8 specific gravity is built up, after four or five charges. This is maintained, and any oil in excess of this depth is skimmed off into a circumferential over-flow compartment, from which it is run off into drums. At present the salvaged oil is being given to the Boro of Grove City for road treatment.

This system has been operating since June of 1949 and has effectively eliminated the discharge of oil into Wolf Creek. An average of 20 barrels of oil per month is collected. Considering the remarkable ability of oil to spread itself in a thin film over water surfaces, it is easy to imagine what a difference 20 barrels of oil per month in a small stream might make. Thus, a company problem has been solved and state and community relations have been elevated to a higher plane of understanding.

Winchester's New Combination Sewage and Industrial Waste Treatment Plant.

Industrial Sewer Rental With Incentive Base

How It Works in Winchester, Va.

by
SAMUEL H. REAVES, *Supt. Water & Sewage Works, Winchester, Va.*

WINCHESTER, Virginia is located in the Shenandoah Valley in the heart of a prosperous agricultural area. The principal products of agriculture are fruits, beef cattle, poultry and dairy products. Winchester is the natural processing center for most of these products, and in addition has a progressive woolen manufacturing industry.

The city is located twelve miles from the Shenandoah River, the largest stream in the vicinity, and all the drainage from the community must go to a small creek which practically dries up during periods of drought. Consequently, ever since construction was started on the sewer system in 1907 the disposal of the wastes from the community has been a major problem, with the facilities for treatment almost continuously inadequate because of expanding industrial production.

The condition of the small stream was such that for a period of more than thirty years the city was subjected to criticism and litigation by property owners enjoying riparian rights to the use of the water. During 1940 plans were started to provide more adequate sewage treatment facilities that would end the problem for as many years as would be economically feasible. These plans were completed and presented to the common council in December 1941, but because of World War 2, no further action was taken until April 1948, at which time contracts were let for construction of a modern high-rate trickling filter plant.

Establishing Equitable Sewer Service Charges

At the time plans were presented to the common council for approval, it was brought out that although the population of Winchester was only a little less than 15,000, the proposed plant would have to be of a size of that for a city of about 50,000 population because of the strong industrial wastes discharged to the sewer system. The common council, with a natural desire to prolong the useful life of the investment to be made, directed that a study be made to develop an equitable basic method for computing sewer rental charges for the treatment of industrial wastes—a rate schedule which would provide a financial incentive for industry to reduce the strength of its waste.

A review of the sewer ordinances in force in Winchester revealed that there was already sufficient regulatory powers available to cover the following items:

1. Discharge of toxic wastes to the sewer.
2. Removal of coarse solids and grit.
3. pH control.

Interior Views Winchester's Treatment Plant.
(Sludge Pumps on left; Sludge Heater on right)

4. Temperature control.
5. Equalization of flow.

These regulations had been in force for a long period of time, but had never been vigorously enforced, so the first step was to achieve compliance with the regulations. It was made mandatory that each plant should install and operate a mechanically operated screen, with the screen being not less than 40 mesh. With enforcement of the regulations, it was decided that B.O.D., suspended solids, and volume would be the determining factors in calculating rental charges.

In order to determine the strength of the wastes discharged from each industrial plant, a weir was set up in a sampling manhole located on the sewer lateral which connected the plant to the sewer main. Samples were collected at fifteen minute intervals and composited, based on the rate of flow over the weir. Continuous samples were taken in this manner over the complete work day of the individual plant. Sampling was continued at each plant for a period of from two to eight weeks depending upon the fluctuations in strength of the wastes from the plant. It was felt that the analytical results obtained in this manner reflected a true picture of the current average strength of the wastes discharged by the individual industry.

In searching through the available literature on sewer-rental charges for treating industrial wastes, it was found that there was little information available to guide the small city in formulating its policy on this matter. Some of the larger cities had established methods of computing charges on an individual industry basis, and others used methods which were quite complex and not easily applicable to the waste problem in Winchester.

Choice of a Formula for Treatment Charges

The determining factors influencing the selection of a formula for deriving treatment charges were that it apply to *all* industry, and that it provide an incentive for industry to reduce the strength of its wastes discharged to the sewer. What appeared to be the most practical method was found in the January 1947 issue of *"Water & Sewage Works"* in an abstract from an article by Dr. S. R. Wright, Head of the Civil Engineering Department at Texas A & M, which had originally appeared in the "Texas Engineer."

(See also Ref. & Data Issue of *W.&S.W.*, May 1949, p 200.—Ed.)

Dr. Wright had evolved a formula whereby the various load factors could be computed simply, and which gave credit to the industry for an equivalent amount of the load that would normally be treated as domestic wastes, and which could be applied to all local industry. The Wright formula is the following:

$$F = \frac{300 + R\,[(S-150) + (B.O.D.-200)]}{300}$$

F = Factor by which volume rate is multiplied.
R = Ratio of the cost of treatment to the total cost of operation of the sewage system.
S = Suspended solids expressed in PPM.
B.O.D. is 5 day Biochemical Oxygen Demand expressed in PPM.

The cost per million gallons for the collection and treatment of the combined domestic and industrial wastes is multiplied by the factor (F) in order to determine the rate per million gallons for the individual industry. This rate is applied to 80% of the metered water consumption of the industry. In Winchester the ratio (R) of cost of treatment is 0.6 (60%) of the total sewer maintenance and operation budget.

Examples of Formula Application

As an example of how the formula is applied, take industrial plants "A" and "B," both consuming 60 million gallons of water annually. Plant "A" has an average suspended solids of 400 PPM and a B.O.D. of 800 PPM. Plant "B' has an average of 200 PPM suspended solids and 300 PPM B.O.D.

For Plant "A"

$$F = \frac{300 + .6\,[(400-150) + (800-200)]}{300}$$

$$F = 2.7$$

Then: Factor 2.7 × $37.00 (Rate Per M.G.) × 48 (80% of Metered Water) = $4,795.20 as the annual sewer rental.

For Plant "B"

$$F = \frac{300 + .6\,[(200-150) + (300-200)]}{300}$$

$$F = 1.3$$

Then: Factor 1.3 × $37.00 (Rate Per M.G.) × 48 (80% of Metered Water) = $2,308.80 as the annual sewer rental.

It is thus easily seen that each industrial plant is charged only for that portion of treatment plant capacity which is utilized to treat its waste.

Experience With the Method

The results during the first year that the incentive method has been in force have been gratifying.

The Virginia Woolen Company has installed removal facilities which have reduced the load from this plant by 56%, and by removing this waste before it enters the sewer system has created additional capacity at the treatment plant equal to the domestic wastes from 4900 people. This company found while investigating its waste problem, that valuable materials were being wasted to the sewer. Equipment was installed and procedures were changed to prevent these

Interior Views Winchester's Treatment Plant.
(Filter Recirculation Pumps, Air Blowers and Control Cabinet on left; Laboratory on right.)

losses, so that in addition to saving one third on sewer rental the company has also a more efficient operation.

The recovery of sugars as a by-product of fruit processing has been a marginal operation, and in the past has been considered a doubtful venture by the industry. However, since the incentive sewer rental has been in force, the removal of these sugars from the wastes discharged to the sewer has resulted in sugar recovery by fruit processers changing from a marginal to a profitable project. The largest local fruit processing plant has installed the necessary equipment and is now recovering these sugars. Preliminary analyses indicate that the strength of the wastes has been reduced by about fifty percent. These preliminary tests are not being taken as conclusive at this time, but it is anticipated that the final figures will not vary much from the fifty percent reduction now being achieved.

In practically all cases where industry has investigated its waste problem, it has devised means to recover valuable materials, and to make more efficient use of man power.

In summary the following conclusions may be drawn.

1. That practically all communities are, or will be confronted with the problem of treating industrial wastes.
2. That industry should pay its fair share of the cost of treatment and that this is a legitimate cost of production item.
3. That, where possible, a readily understood and uniform method of computing sewer service charges should be adopted.
4. That the method and formula adopted should offer a financial incentive for industry to reduce the strength and amount of wastes discharged to the sewer system.
5. That an incentive method of computing sewer service charges for industry will release sewage treatment plant capacity, which becomes available to other industry or for additional domestic sewage.

A.A. Appel L.A.'s Sewer Maint. Supt.

Announcement has been made of the appointment of A. A. Appel as Superintendent of Sewer Maintenance for the City of Los Angeles to fill the vacancy left by the death of R. F. Brown. Mr. Appel had been

acting Superintendent for the past year while Mr. Brown was on leave, and prior to that time he had been Assistant Superintendent of Sewer Maintenance for a number of years. Appointed to fill Mr. Appel's old position of Asst. Supt. was James L. Carey, who had been in the department for a number of years.

Officers of the North Dakota Water & Sewage Works Conference

Front Row (L. to R.)
Vice President Kenneth Johnson, Supt., Sewage Plant, Dickinson; *President* H. H. Behlmer, Asst. Supt., Fargo Water Plant; *Sec.-Treas.* Jerome H. Svore, Chief San. Engr., N.D. State Dept. of Health.

Last Row (L. to R.)
Directors Edward Booth, City Engr., Bismarck; P. K. Lewis, Portland Cement Assoc., Fargo; C. T. Stephenson, Asst. Engr., State Hospital, Jamestown; T. C. Lofgren, Cutler-Magner Co., Grand Forks.

(Director Torwald Torgerson, Supt. of Water, Rugby, not in picture.)

Graphical Approach to Statistics*

IV Evaluation of Bacterial Density

by
C. J. VELZ, *Chairman, Dept. of Public Health Statistics*
School of Public Health, University of Michigan

The proper evaluation of data in sewage works operation and stream pollution studies cannot be accomplished by simple mathematical averages of a series of analytical results. "Statistical evaluation offers the only means of condensing raw data to concise form, permitting significant interpretation," according to the author. This series of articles on the "Graphical Approach to Statistics," has been prepared especially for *Water & Sewage Works* to show how the usual forbidding methods of statistics can be used by means of graphic solutions. These articles may well revolutionize future work in this field with particular reference to water and sewage analysis for chemical and bacteriological constituents. —The Editors.

THIS article will deal with logarithmic probability paper as applied to the evaluation of bacterial density. Certain types of data such as bacterial density determined by the decimal dilution method, are logarithmically normal. Such a distribution will plot as a straight line on normal probability paper previously described (August 1950 issue of *Water & Sewage Works*) providing the logarithms of the measurements are substituted for the original data. Log-probability paper avoids converting the data to logarithms by employing a logarithmic grid as the ordinate scale. The original data may then be plotted directly on the log-grid.

Fig. 15 illustrates a logarithmically normal distribution plotted on log-probability paper. The X and X′ scales are identical with those previously described for normal probability paper; X-scale at the bottom is probability (in percent) equal to or less than or probability of not exceeding, X′-scale at the top is deviation from the mean in terms of standard deviation. The left ordinate scale, Y, is a logarithmic grid assigned to the scale of measurement of the original data; Y′-scale at the right is a linear grid on which logarithms of the original data are located.

Plotting on Log-Probability Paper

The procedure in plotting on log-probability paper is similar to that employed for normal probability paper:

(1) Arrange the data in order of ascending magnitude.

(2) Assign a serial number "m" to each of the n values, 1, 2, 3, ... n.

(3) Compute the plotting position of each serial value, giving the probability equal to or less than for each value by the expression $m/(n + 1)$ expressing the ratio as a percentage.

(4) The units of measurement of the original data are laid off on the logarithmic grid* as the Y-axis and the plotting positions are the probability scale on the X-axis. The points are plotted using these (X, Y) coordinates. (Table 7 shows the coordinates for the 16 value plotted on Fig. 15)

Table 7

16 Samples Taken Simultaneously from the Same Source 10 Portions in Each of 3 Decimal Dilutions

MPN per ml in order of Magnitude Millions	Serial Number m	Plotting Position m/(n+1) as %
2.88	1	5.9
3.29	2	11.8
3.29	3	17.6
3.34	4	23.5
3.99	5	29.4
3.99	6	35.3
4.74	7	41.2
4.74	8	47.0
4.93	9	52.8
4.93	10	58.3
5.89	11	64.6
6.22	12	70.5
6.22	13	76.5
7.00	14	82.3
7.42	15	88.2
9.33	16	94.1

In interpreting a plot on log-probability paper it is cautioned that while the original data are plotted on the Y scale, actually it is the corresponding Y′ values, the logarithms of the original data, that form the normal distribution. Hence the mean and the standard deviation are expressed in terms of logarithms. The subscript (Log) is employed to indicate that a logarithmically normal distribution is dealt with. The procedure for determining graphically the $\text{mean}_{(\text{Log})}$ and $\text{sigma}_{(\text{Log})}$ is identical with that described for normal probability paper except that Y′ scale is employed. Referring to Fig. 15

$$\text{Mean}_{(\text{Log})} = 6.687$$

located on the Y′ scale opposite (a) where 50 per cent cuts the distribution line. This is equivalent to the arithmetic mean of the logarithms of the original values.

The slope of the distribution line is the measure of variation of the data and provides the standard deviation in terms of logarithms.

$$\sigma_{(\text{Log})} = \frac{\Delta Y'}{\Delta X'} = .174$$

$\Delta Y'$ is measured on Y′ scale and $\Delta X'$ is measured on the X′ scale.

It is cautioned that in computing analytically ranges for any confidence it is essential first to deal in terms of logarithms. After the logarithms of the limits of any range are determined their anti-logs can be obtained and results expressed in terms of the original units of measurements. The advantage of log-probability paper is that these conversions are automatically accomplished. Again referring to Fig. 15, the $\text{mean}_{(\text{Log})}$ 6.687, is converted to units of the original measurement simply by reading directly on the Y scale, giving a value 4,860,000 per ml. Similarly the range for $\text{mean}_{(\text{Log})} \pm 2\sigma_{(\text{Log})}$ in terms of logarithms is

$$6.687 \pm 2 \times .174 \qquad (6.339 \text{ to } 7.035)$$

located by (b) and (c) where -2σ and $+2\sigma$ intersect the distribution line, reading on the Y′ scale. The limits of this range converted to units of the original measurements are directly obtained by reading on the Y scale

(2,180,000 per ml to 10,820,000 per ml)*

*Parts I, II and III appeared in May, August and October, 1950.

*If more than two log cycles are needed, sheets of log-probability paper can be pasted together.

*Note, that the deviations in terms of the original units of measure (Y) are not equal about the mean; $2\sigma_{(\text{Log})}$ plus $\text{mean}_{(\text{Log})}$ pro-

duces a Y of 10,820,000 or 5,960,000 above the mean of 4,860,000 while $2\sigma_{(Log)}$ minus $mean_{(Log)}$ produces a Y of 2,180,000 only 2,680,000 below the mean. This is inherent in the skew of the *logarithmically* normal distribution.

Concepts of Mean Density and Distribution of Bacteria

It is first essential to introduce some basic concepts about bacterial density in a liquid medium. If it were possible to count the entire bacterial population in the entire water supply, the true *Mean Density* (M.D.) would be the total count divided by the total volume. If less than the total volume were employed in counting, it would be found that the densities in the samples would vary about the true Mean Density, the smaller samples showing greater variation than the larger samples. Perfect admixture would require exactly the same number of bacteria in each and every unit volume; complete segregation, on the other hand, would require all cells to be located in one single unit volume. Such extreme distributions of bacteria among unit volumes of water do not exist. The actual distribution is random and would tend toward an equilibrium condition between these extremes governed by the laws of chance.

Inherently, therefore, we expect variation in results from small samples even if they are all drawn from the same supply at the same instant. Fortunately, the nature of these expected variations can be defined and series of test results can be reduced to reliable estimates of the true Mean Density as the basic measure of bacterial quality.

Nature of Variation of MPN's

Three fundamental characteristics of the nature of variation in MPN's determined from test results employing multiple portions in three decimal dilutions are:

(1) The distribution is logarithmically normal, that is, series of MPN's plot as a straight line on log-probability paper.

(2) The estimate of the true *Mean Density* is located at the midpoint of the distribution at 50 per cent.

(3) The slope of the distribution line depends upon the number of portions employed; small number of portions steep slope, wide variation; large number of portions flat slope, narrow variation.

These characteristics can be developed mathematically [1] and verified experimentally.

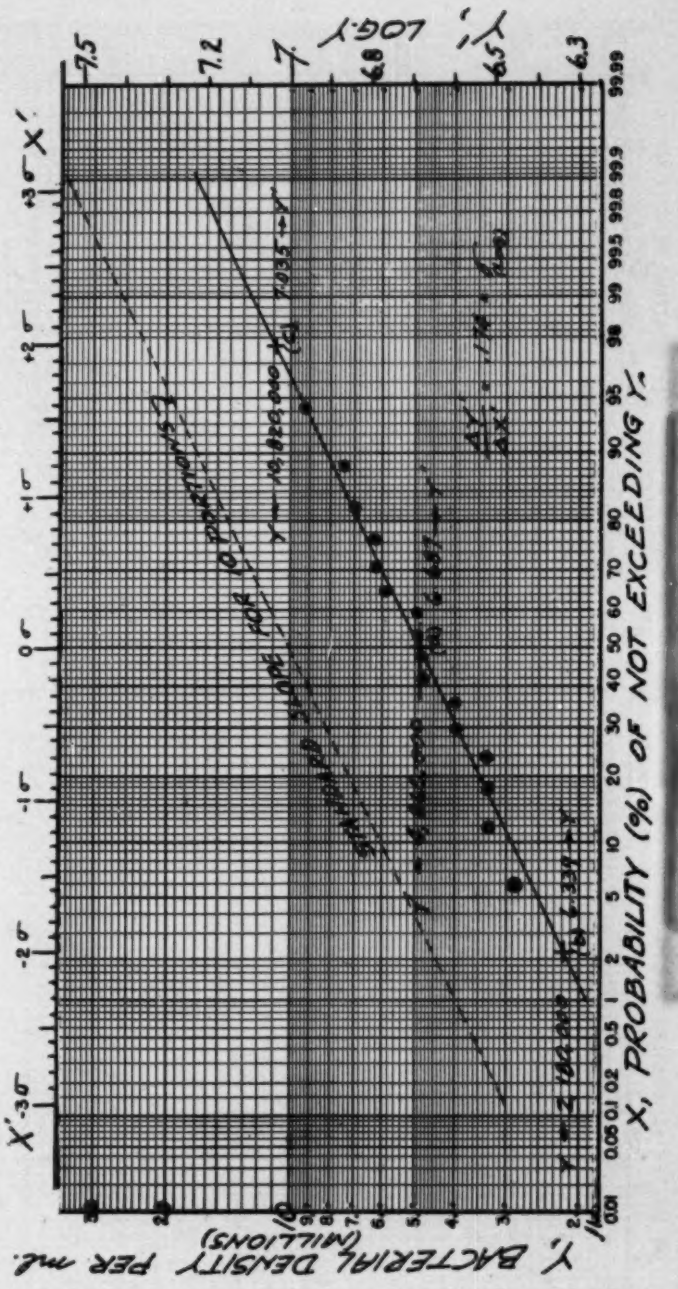


Fig. 15—Verification of Standard Slope—10 Portions in Each of 3 Decimal Dilutions

Figure 16, shows the results of theoretical probability distribution of possible results from *20 portions* in each of 3 decimal dilutions with a known true Mean Density of 1.5 bacteria per ml. Note:

(1) Almost a perfect straight line develops.

(1) *Proceedings Inservice Training Course in Sewage and Industrial Waste Disposal*, 1949, School of Public Health, University of Michigan.

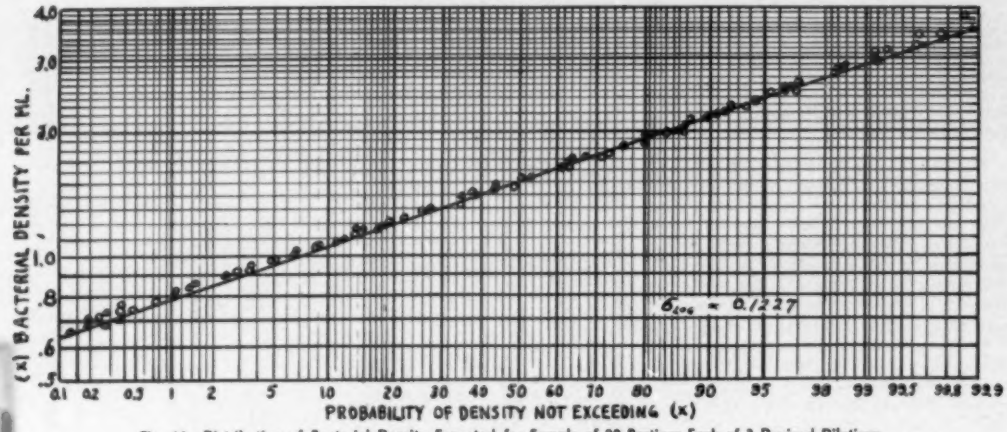


Fig. 16—Distribution of Bacterial Density Expected for Sample of 20 Portions Each of 3 Decimal Dilutions at True Mean Density of 1.5 per ml.

(2) The distribution line cuts 50 per cent at a density of 1.5 which is equal to the theoretical true Mean Density employed.

(3) The slope is relatively flat, with $\sigma_{(Log)} = 0.1227$.

Figure 17, likewise, shows the results of theoretical probability distribution of possible results with the same true Mean Density 1.5, but employing only *5 portions* in each of 3 decimal dilutions. Note again:

(1) A straight line develops.

(2) The distribution line cuts 50 per cent at the theoretical true Mean Density of 1.5.

(3) The slope is steeper with $\sigma_{(Log)} = 0.2454$

More generally $\sigma_{(Log)}$, the slope, is related to the number of portions (n) as

$$\sigma_{(Log)} = \frac{.5487}{\sqrt{n}}$$

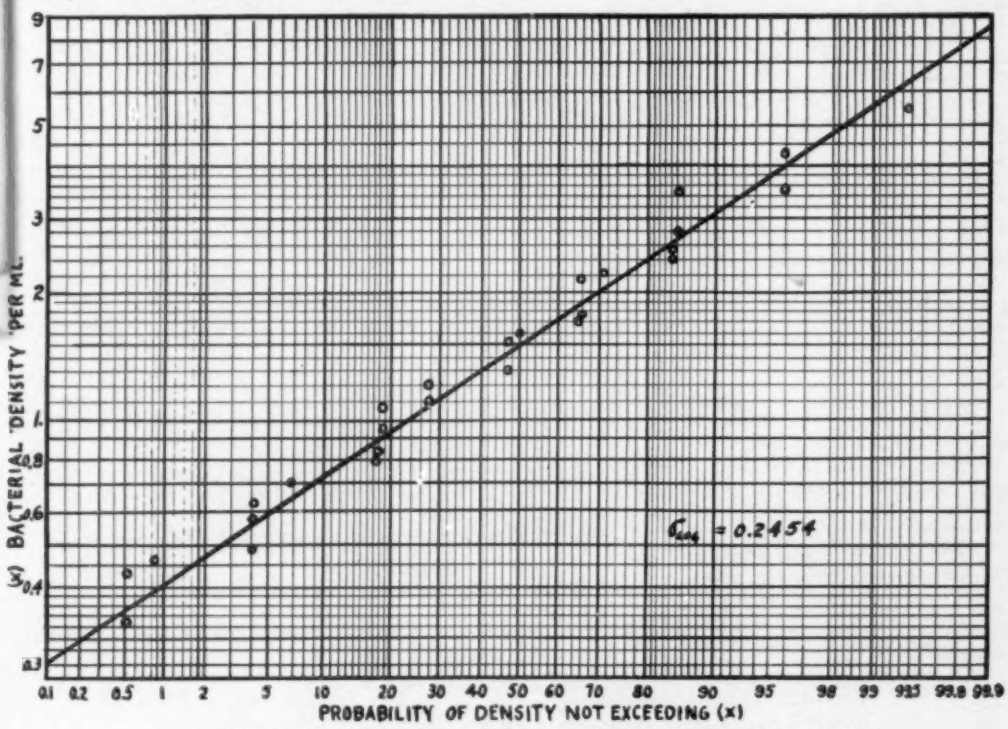


Fig. 17—Distribution of Bacterial Density Expected for Sample of 5 Portions Each of 3 Decimal Dilutions at True Mean Density of 1.5 per ml.

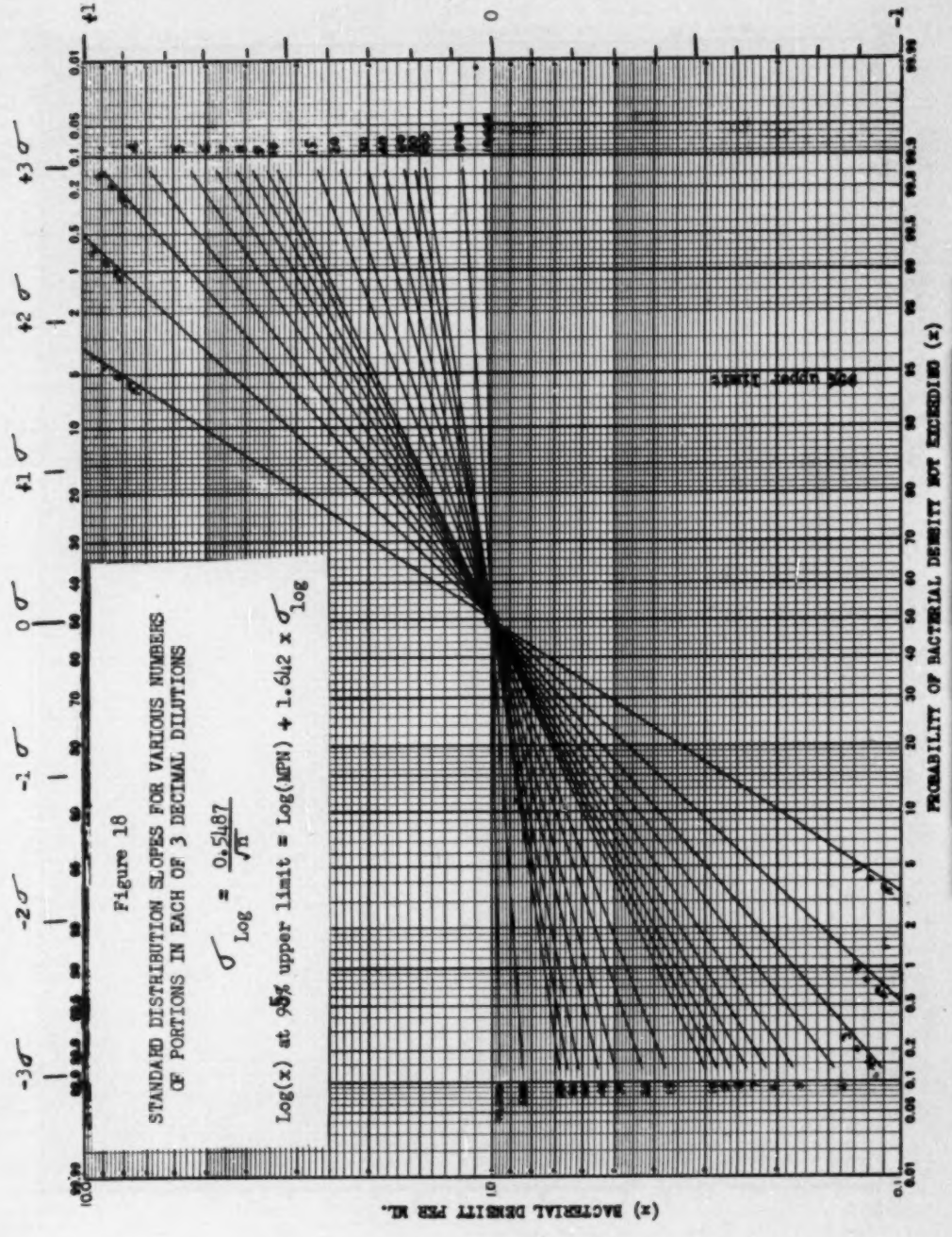


Figure 18
STANDARD DISTRIBUTION SLOPES FOR VARIOUS NUMBERS OF PORTIONS IN EACH OF 3 DECIMAL DILUTIONS
$\sigma_{Log} = \frac{0.5487}{\sqrt{n}}$
Log(x) at 95% upper limit = Log(MPN) + 1.642 x σ_{log}
95% upper limit
(x) BACTERIAL DENSITY PER ML.
PROBABILITY OF BACTERIAL DENSITY NOT EXCEEDING (x)

Fig. 18—Standard Distribution Slopes for Various Numbers of Portions in Each of 3 Decimal Dilutions

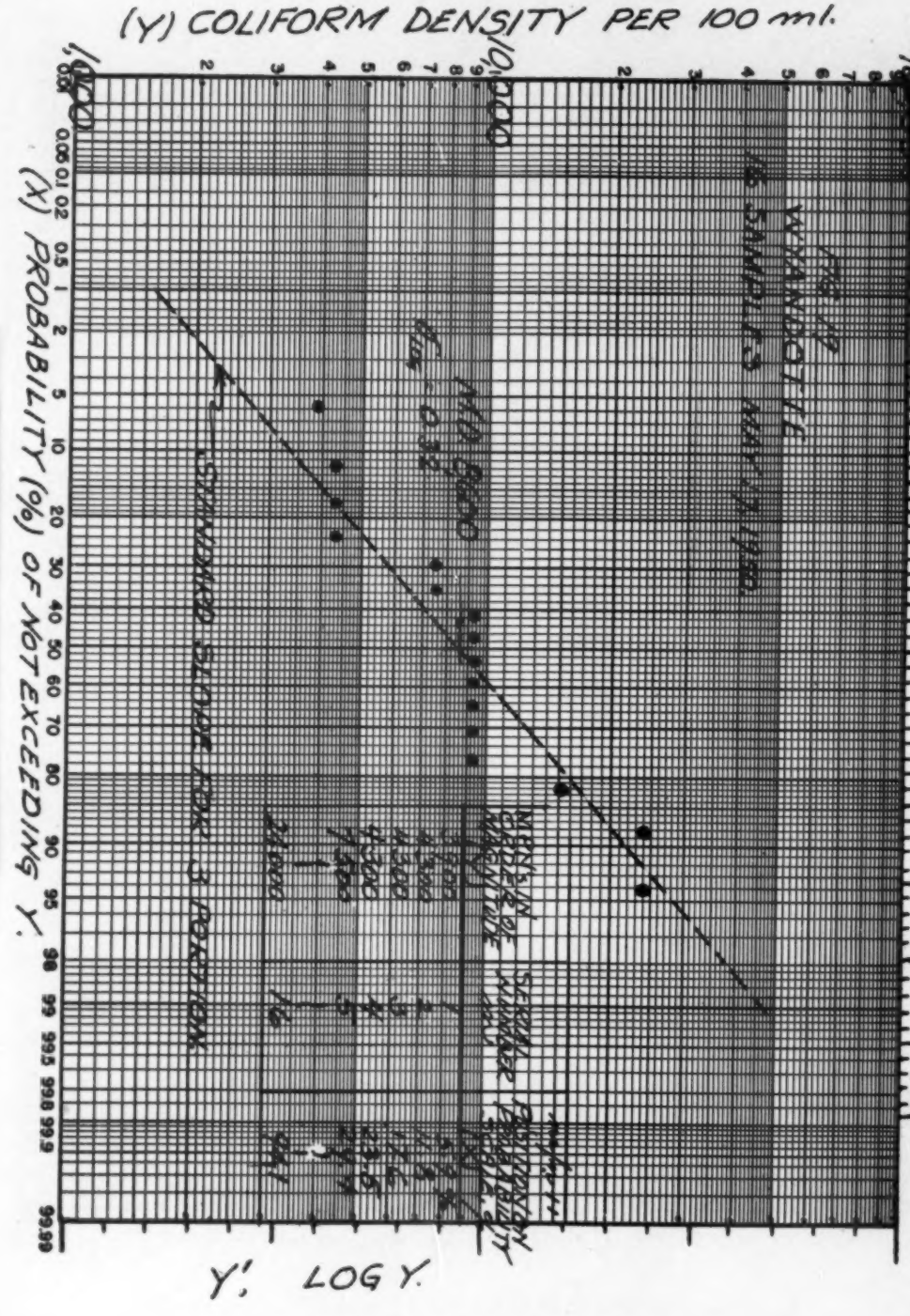

(Y) COLIFORM DENSITY PER 100 ml.
(X) PROBABILITY (%) OF NOT EXCEEDING Y.
Y' LOG Y.
WYANDOTTE
16 SAMPLES MAY 17, 1950
MEDIAN
STANDARD SLOPE FOR 3 POPULATION

Fig. 19—Wyandotte, Mich.—16 Samples May 17, 1950

Graphically, the slope ($\sigma_{(Log)}$) for various values of (n), number of portions, is shown in Fig. 18. These are the standard distribution slopes expected purely by virtue of the test procedure, depending solely on the number of *portions* employed. All the distribution lines arise from water of the same Mean Density but the variation of individual MPN values can be expected to be greater and greater as the number of portions is decreased.

Hence to know the reliability of an MPN it is essential to know the number of *portions* employed in the test procedure.

These relationships can be verified experimentally by taking a set of samples simultaneously from the same source, thus insuring a constant Mean Density for all samples. Fig. 15, previously referred to, represents the distribution of MPN values for 16 samples taken from a controlled source in such a manner, each sample composed of *10 portions* in each of 3 decimal dilutions.

The slope of the line described by the plotted points is in remarkable agreement with the theoretical or standard slope expected when 10 portions are employed, namely $\sigma_{(Log)} = 0.1735$. As the number of samples increases the experimental slope approaches the theoretical standard slope as a limit. This holds of course only if there is no change in the true Mean Density during the period when samples are drawn.

Figure 19 is the distribution of MPN's of a set of 16 samples taken simultaneously from a raw water supply, employing *3 portions* in each of 3 decimal dilutions. When only 3 portions in each of 3 decimal dilutions are employed the number of possible outcomes is less and the distribution is less continuous in character, but the points describe a line in close agreement with the theoretical or standard slope expected for *3 portions*, namely, $\sigma_{(Log)} = 0.32$.

If samples are taken over a time interval, such as daily routine samples over a period of a month, true Mean Density undoubtedly would not remain constant and hence the daily MPN's would be drawn from water of changing quality. Under these conditions of changing quality, the distribution line described by the individual MPN's will be steeper than that where quality remained constant. Hence the comparison of the actual slope with that expected for the number of portions employed indicates at once if quality remained stable or was subject to real changes in level of Mean Density during the sampling period. A graphical method for determining the extent of such a change in Mean Density is illustrated in the following examples.

Evaluation of Raw Water Supply Data

Figure 20 represents the application of log-probability paper to evaluation of coliform density of the raw water supply for the City of Wyandotte, Mich.,* based upon daily routine samples of 3 portions in each of 3 decimal dilutions for the 71 day period July 22 to Sept. 30, 1950. A reasonably straight line distribution is described by the distribution of the 71 MPN values shown as heavy dots.

THE MEAN DENSITY—The graphical line "A" through the data cuts 50 per cent at $Mean_{(Log)}$ of 4.447 (read on Y'-scale or a Mean Density of 28,000 coliform per 100 ml (read on Y-scale).

THE SLOPE, $\sigma_{(Log)}$—The slope of the distribution line "A" determines $\sigma_{(Log)}$ which is given by scaling Δ Y' for a unit Δ X' in this example

$$\sigma_{(Log)} = .49$$

MEASURE OF STABILITY OR CHANGE IN MEAN DENSITY—The slope expected for a *3 portion* test procedure as transferred from the standard slopes of Fig. 18, is indicated on Fig. 20 as the dotted line "B". The actual distribution line "A" is steeper than that expected for a 3 portion test procedure which indicates at once that changes in level of Mean Density, and therefore real changes in quality, took place during the sampling period.

The question now arises: Within what range did the level of Mean Density shift? The answer to this depends upon a confidence we wish to have in the range defined. A range for a 90 per cent confidence would have a lower limit not exceeding 5 per cent and an upper limit not exceeding 95 per cent. Such a range in Mean Density is readily located graphically by projecting parallel to the standard slope line "B" from the intersections of 5 and 95 per cent with the distribution line "A". Probability of 5 per cent intersects line "A" at (a) (4,400); projecting parallel to line "B" to probability of 50 per cent locates the lower limit of Mean Density at (w) (14,500).

Similarly, probability 95 per cent intersects line "A" at (b) (175,000); projecting parallel to line "B" to probability 50 per cent locates the upper limit of Mean Density at (z) (52,500). This is to say that if 5 per cent of the MPN values do not exceed 4,400, (a), and the quality of water remained stable during sampling, the distribution line would fall along (a) (w) and would define a Mean Density of 14,500 located by (w).

Similarly if 95 per cent of the MPN values did not exceed 175,000, (b), and quality remained stable the distribution line would fall along (b) (z) and would define a Mean Density of 52,500 at (z). From this it is then reasoned that the probability is 5 per cent, that Mean Density was equal to or less than 14,500 and the probability is 5 per cent that Mean Density was equal to or greater than 52,500; or the probability is 90 per cent that Mean Density varied within the range 14,500 to 52,500, between (w) and (z).

In a similar manner the range for any confidence can be defined. We are 50 per cent confident that the Mean Density varied within the range 21,000 to 36,000; or 98 per cent confident that it varied within the range 11,000 to 70,000.

Since samples were taken at daily intervals, it can be reasoned that:

50 per cent of the days the Mean Density was above or below 28,000

50 per cent of the days the Mean Density was within the range 21,000 to 36,000

90 per cent of the days the Mean Density was within the range 14,500 to 52,500

98 per cent of the days the Mean Density was within the range 11,000 to 70,000

These ranges in Mean Density are a measure of the variation in real changes in level of quality, free of the influence associated purely with test procedure employed. It follows also that comparisons should be made in terms of Mean Density, not between individual MPN values.

Evaluation of Sewage Treatment Data

Fig. 21 illustrates an application of log-probability paper to the evaluation of coliform density of influent and effluent of Buffalo, N.Y.* sewage treatment works based upon 117 routine samples of 3 portions in each of 3 decimal dilutions taken 3 to 6 times daily except Sundays during the month of May 1949.

Line "A" is the distribution of the 117 MPN's of influent, indicating a reasonably straight line. The Mean Density is located at (a), 67,000 coliform per ml. (read on Y scale); and $\sigma_{(Log)}$ is 0.37.

*Data courtesy George Hazey.

*Data courtesy of George Fynn, Chief Chemist.

The slope of line "A" is only slightly steeper than that expected for a 3 portion test procedure and hence Mean Density remained reasonably stable during the month, ranging from 56,000 to 80,000 for 90 per cent confidence.

and the standard slope expected for a 3 portion test procedure. This indicates at once that changes in level of Mean Density and therefore real changes in quality of effluent took place during the month. By projecting parallel to the standard slope for

was above or below 800 per ml.
50 per cent of the time Mean Density was within the range 400 to 1,600 per ml.
90 per cent of the time Mean Density was within the range 145 to 4,500 per ml.

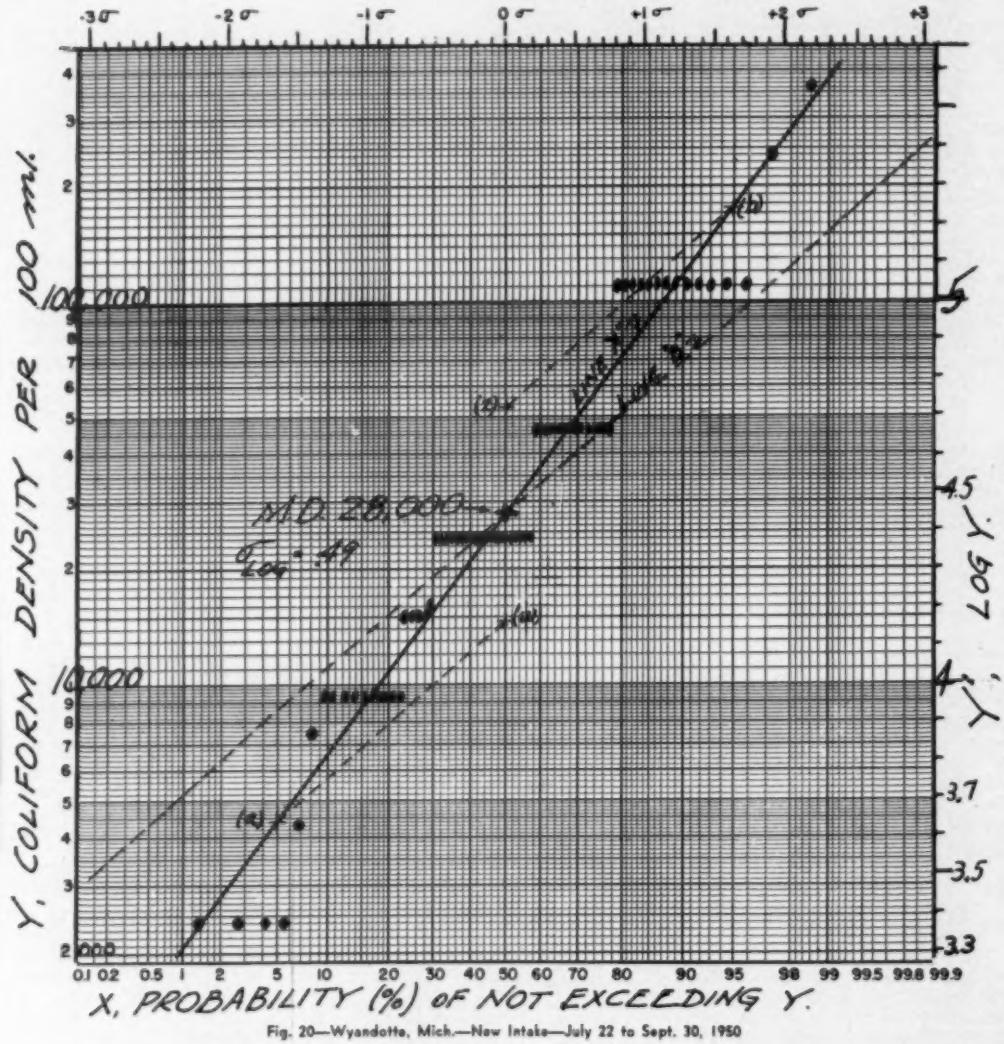


Fig. 20—Wyandotte, Mich.—New Intake—July 22 to Sept. 30, 1950

Line "B" represents the distribution of 117 MPNs of effluent. Again a straight line is indicated with a Mean Density located at (b), 800 coliform per ml. (read on Y scale) and $\sigma_{(Log)}$ of 0.79. The slope of the effluent, line "B", is about twice as steep as that of the influent, line "A"

3 portion test procedure from any desired probability intercept on line A to the 50 per cent probability gives the range in Mean Density for any desired confidence. If we assume that samples were taken at equal intervals (approximately true) it can be reasoned that

50 per cent of the time Mean Density

The disinfection efficiency of the treatment system is determined by comparison of the Mean Densities of the influent and effluent, 68,000 per ml. and 800 per ml. respectively, indicating an average reduction in bacterial density of 98.8 per cent.

(Part V will appear in a forthcoming issue.)

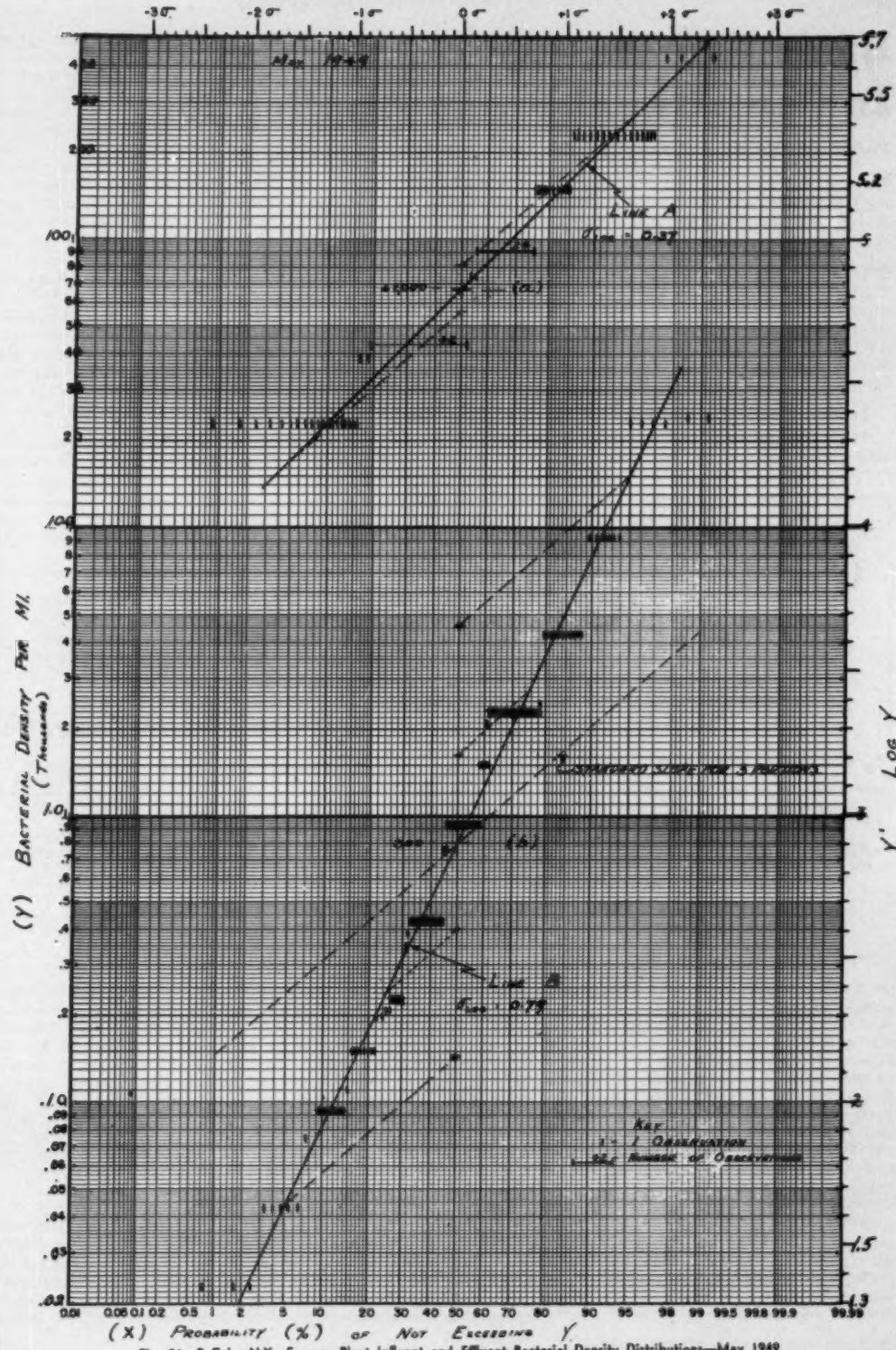


Fig. 21—Buffalo, N.Y., Sewage Plant Influent and Effluent Bacterial Density Distributions—May 1949

Basic Factors In Centrifugal Pump Application

Part 2—Pump Head Terms, Definitions and Determination

by
ROY CARTER *and* I. J. KARASSIK, *Application Engineers,*
Worthington Pump and Machinery Corp., Harrison, N.J.

THE preceding portion* of this article discussed head terms of a general nature. This installment will cover head terms used with pumps and, except as otherwise noted, the definitions are based on the current Standards of the Hydraulic Institute.

Suction Head—Suction Lift

As now defined, the total suction head (symbol h_s) is the static head on the pump suction line above the pump centerline minus the friction head losses, including entrance loss in the suction piping for the capacity being considered, plus any pressure (a vacuum being a negative pressure) existing in the suction supply line. Rather than express the suction head as a negative value, the term "suction lift" is generally used when the suction head is negative or when the pump takes its suction from an open tank under atmospheric pressure. As a suction lift is a negative suction head measured below atmospheric pressure, the total suction lift (symbol also h_s) is the static suction lift measured to the pump centerline plus the friction head losses as defined above. (In some cases it is advantageous to express both suction and discharge heads in absolute pressure but generally it is suitable to measure them above or below atmospheric pressure.) A gage on the suction line to a pump, when corrected to the pump centerline, measures the total suction head above atmospheric pressure minus the velocity head at the point of attachment. As a suction lift is a negative suction head, a vacuum gage will indicate the sum of the total suction *lift* and velocity head at the point of attachment.

The three most common suction supply and pump relations are illustrated on Fig. 8.

Case I of Fig. 8 involves a supply in a tank under a pressure other than atmospheric and includes all the components of suction head. If h_s is to be expressed as a gage reading and P_s is a partial vacuum, the vacuum expressed in feet of liquid is a negative pressure head and would have a minus (—) sign. If the pressure P_s is expressed in absolute pressure values, h_s will also be in absolute pressure values.

Case II is a very common installation with a suction supply under atmospheric pressure located above the pump centerline. Therefore the suction head (expressed as a gage value) has a P_s value of zero which can be dropped from the formula.

Case III is the most common installation for pumps handling water and involves a supply located below the pump centerline. In such a case it is optional whether the suction head be expressed as a negative suction head or in positive values as a suction lift. As the source of supply is below the pump centerline which is the datum line, S is a negative value in our calculations for suction head. It is to be noted that the suction lift formula is the same as for suction head except that both sides have been multiplied by minus one (—1). A gage attached to the pump suction flange corrected to the pump centerline will register a partial vacuum or negative pressure. To get the suction head it is therefore necessary to add *algebraically* the velocity head to this

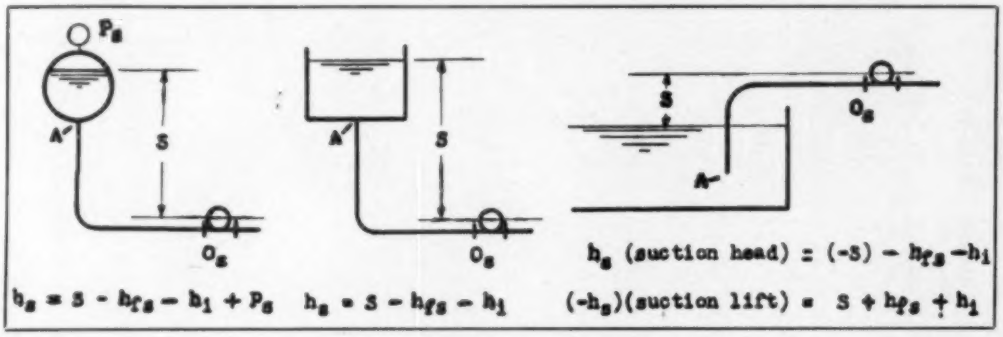


Fig. 8—Suction Head Determination for Three Typical Cases.

Case I	Case II	Case III
Suction from source under pressure greater or less than atmospheric and located above pump centerline.	Suction from source under atmospheric pressure and located above pump centerline.	Suction from source under atmospheric pressure and located below pump centerline.

NOMENCLATURE OF HEADS NOT SHOWN ON DIAGRAMS

h_1 = entrance loss at A
h_{fs} = total friction loss from A to O_s
h_{vs} = velocity head at O_s
h_{sg} = gage reading at O_s corrected to pump centerline = $h_s - h_{vs}$

*Part 1—W. & S. Wks. Jan. 1951.

negative pressure or, if it is desired to work in terms of vacuum, the velocity head is substracted from the vacuum to get the suction lift. For example if the gage attached to the suction of a pump with a 6" suction pumping at a capacity of 1000 GPM of cold water showed a vacuum of 6" of mercury (equal to 6.8 feet of water), the velocity head at the gage attachment would be 2.0 feet of water and the suction head would be (—6.8+2.0) or —4.8 feet of water or the suction lift would be (6.8—2.0) or 4.8 feet of water.

As *most* centrifugal pump troubles occur on the suction side of the pump, it is very important that inquiries for new pumps give the vendors complete information on the suction conditions including any variations that will be encountered in operation. For some complex problems it is often necessary to show the variation in total suction head graphically superimposed on the suction head limitations of the pump being considered in order to see if the pump is suitable.

The Term NPSH

In the pumping of liquids, the pressure at any point in the suction line must not be reduced to the vapor pressure of the liquid. The available energy that can be utilized to get the liquid thru the suction piping and suction waterway of the pump into the impeller is thus the total suction head less the vapor pressure of the liquid at the pumping temperature. The available head as measured at the suction opening of the pump has been named "Net Positive Suction Head" and is generally indicated by its initials, NPSH.

Both the suction head and the vapor pressure should be expressed in feet of liquid being handled and must both either be in gage or absolute pressure units. A pump handling 62°F. water (vapor pressure=0.6 ft.) at sea level with 0 feet total suction lift, has an NPSH of 33.9—0.6=33.3 feet, while one operating with 15 feet total suction lift has an NPSH of 33.9—0.6—15=18.3 feet.

A pump operating on a suction lift will handle up to a certain maximum capacity of cold water without cavitation occurring. Under these conditions, the NPSH or amount of energy available at the suction nozzle of the pump is the atmospheric pressure minus the sum of the suction lift and the vapor pressure of the water. To handle this same capacity with any other liquid, the same amount of energy must be available at the suction nozzle. Thus, in case of a liquid at its boiling point, (point at which the liquid begins to pass into vapor regardless of degree of negative pressure or temperature), this energy has to exist entirely as a positive head while, if the liquid is below its boiling point, the suction head required is reduced by the difference between the pressure existing in the liquid and the vapor pressure corresponding to the temperature.

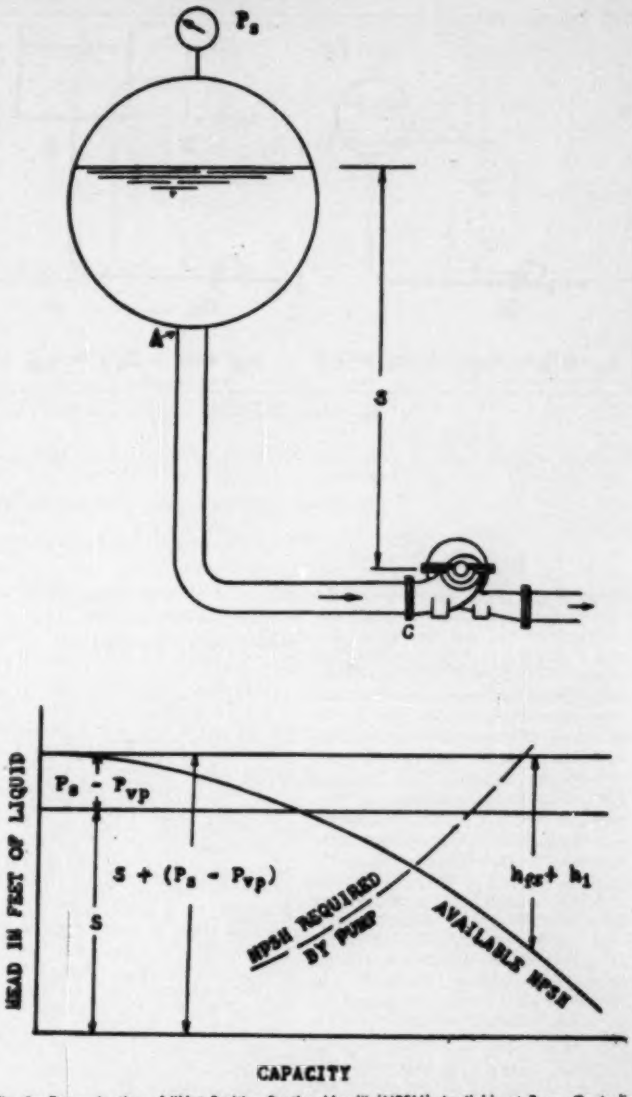


Fig. 9—Determination of "Net Positive Suction Head" (NPSH) Available at Pump Centerline and Relationship of NPSH, Head and Pump Capacity.

$$NPSH = S + (P_s - P_{vp}) - (h_{fs} + h_i)$$

h_{fs} = friction loss in suction line from A to C
h_i = entrance loss at A
P_{vp} = vapor pressure of liquid at pumping temperature

All heads and pressures must be expressed in feet of liquid at the pumping temperature with proper algebraic signs. While P_s and P_{vp} can either be in gage or absolute values, they must both be measured above the same datum. Some engineers include h_i as part of h_{fs}.

It is necessary to differentiate between available NPSH and required NPSH. The former represents a characteristic of the system in which

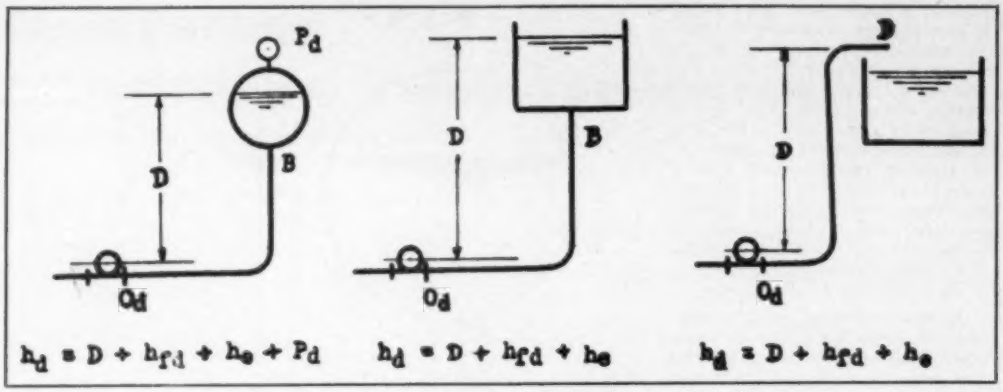


Fig. 10a.—Determination of Discharge Heads for Three Typical Discharge Layouts.

CASE I
Discharge into elevated tank under pressure greater or less than atmospheric.

CASE II
Discharge into bottom of elevated tank under atmospheric pressure.

CASE III
Discharge over edge of elevated or open ground tank.

NOMENCLATURE OF HEADS NOT SHOWN ON DIAGRAMS

h_e = exit loss at B
h_{fd} = total friction loss from O_d to B.

a centrifugal pump works and is the difference between the existing absolute suction head and the vapor pressure at prevailing temperature. The required NPSH is a function of the pump design and represents the minimum required margin between suction head and vapor pressure at a given capacity.

Both the available and required NPSH vary with capacity as illustrated in Fig. 9. With a given static pressure or elevation difference at the suction side of a centrifugal pump, the available NPSH is reduced with increasing capacities due to the friction losses in the suction piping. On the other hand, the required NPSH, being a function of the velocities in the pump suction passages and at the inlet of the impeller, increases basically as the square of the capacity.

A great many factors, such as eye diameter, suction area of the impeller, shape and number of impeller vanes, area between these vanes, shaft and impeller hub diameter, impeller specific speed, the shape of the suction passages and many more enter, in some form or another, into the determination of the required NPSH.

Suction limitations for given capacities in a specific pump were formerly expressed in terms of permissible suction lift at sea level. This required considerable calculation if the pump was to handle water at higher temperatures, if the pump was to handle a liquid other than water, or if the pump was installed at some location above sea level. There is a marked tendency to indicate the capacity vs suction limitation of all centrifugal pumps in a NPSH vs capacity form.

How Suction Conditions Are Specified

The importance of accurately advising the manufacturer of the actual suction conditions for a centrifugal pump at the time of its purchase cannot be over-emphasized. A pump will be unable to meet its design capacity conditions unless the suction head can provide enough energy to get the liquid into the pump as discussed above under the subject of NPSH. If a cold non-volatile liquid is to be handled, it is necessary to know whether there is head on the suction or whether the pump will handle a suction lift and if the latter, what will be the maximum lift. In the event that the liquid is hot or under a pressure corresponding to or near to its vapor pressure, the pump must be installed so as to provide head on the suction and the available submergence must be made known. In case of liquids other than water, information on the pumping temperatures and vapor pressure is also necessary.

Any expected or likely variations in the suction conditions—from maximum to minimum should also be specified.

Discharge Head

The discharge head (symbol h_d) of a centrifugal pump is the head measured at the discharge nozzle and can be expressed in absolute or gage readings.

The discharge head in a system is the algebraic sum of the static head, the friction head losses for the capacity being considered, the exit loss at the end of the discharge line and the terminal head or pressure expressed in feet of liquid.

Established practice is to express the discharge and suction heads of a horizontal pump with the pump centerline as datum and, usually, the discharge and suction head of a vertical pump is given with the centerline of the discharge as datum. The discharge and suction heads can be given with other elevations as datum but, in such cases, it is necessary to indicate at what datum the heads are measured. This practice is often necessary, because, prior to the purchase of a pump, the exact elevations of the pump centerline or discharge centerline have not been determined.

A gage at the pump discharge, when the reading is corrected to the pump centerline, will indicate the discharge head minus the velocity head at the point of attachment.

Typical Discharge Systems

Some typical discharge systems are illustrated in Fig. 10.

Case I shows a system in which the pump delivers to an elevated pressure or vacuum tank in which a pressure other than atmospheric exists, and therefore includes *all* the components of discharge head.

Case II is similar to Case I except that atmospheric pressure exists on the discharge liquid level such as is the case with pumps delivering to open reservoirs and elevated tanks. In this case, and those which follow, if the discharge head is to be expressed as a

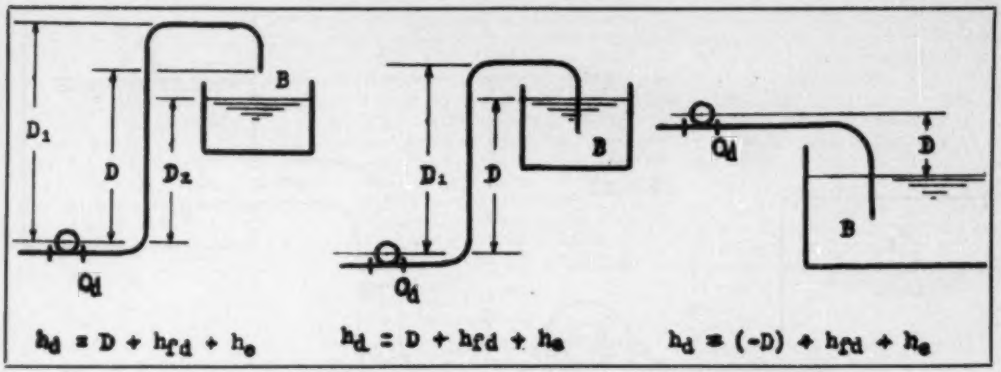


Fig. 10b.—Determination of Discharge Heads for Three More Typical Discharge Layouts.

CASE IVa
Discharge through syphon loop into elevated tank. (Discharge not sealed)

CASE IVb
Discharge through syphon loop into elevated tank. (Discharge sealed)

CASE V
Submerged discharge at elevation below pump centerline.

NOMENCLATURE OF HEADS NOT SHOWN IN DIAGRAMS

h_e = exit loss at B.
h_{fd} = total friction loss O_d to B (including syphon losses.)
h_{vd} = velocity head at O_d
h_{dg} = gage reading at O_d corrected to pump centerline $h_d - h_{vd}$.

gage reading, P_d is zero and is therefore not shown in the formulas. Should it be necessary to express the discharge head in absolute values, the atmospheric pressure expressed in feet of liquid is added to the discharge head expressed as a gage reading.

While Case III illustrates an overhead tank, it applies to all cases of "overboard discharge." The actual useful static head (the distance from the pump centerline to the discharge water level) is less than the actual static discharge head D. It is possible, however, to recover part if not all of this by incorporating a siphon leg (see illustrations for Cases IVa, IVb, and V) on the discharge. While Case IVb and Case V would theoretically be the most efficient, it is often desirable for other reasons not to use a sealed discharge. One reason is to prevent the possibility of a backsyphonage when the pump is stopped.

In Case IVa and IVb, a siphon leg is involved and the effectiveness of the siphon will depend both upon the length of the siphon leg and the design of the piping. Varying with the design, the recovery could be anything from 0 to 100%. For example, in Case IVa, if the pipe were very large for the capacity, the pipe would not run full and, as a result, the actual static discharge head would be the distance to the existing (actual) water level in the loop of the piping. All cases involving a siphon leg have to be investigated carefully to see what percentage of head recovery can be expected and the loss included in the friction loss (h_{fd}).

As the absolute pressure at any point in a siphon must be in excess of the vapor pressure of the liquid, it is theoretically possible to have a siphon leg approaching 34 ft. at sea level if the water is cold and air free. In most cases, the water being handled is not air free and a reduction in pressure below atmospheric causes separation of this air thus reducing the effectiveness of the siphon. With water, siphons more than 20 feet high are rarely encountered. It is also questionable if many of those even under 20 feet are 100% effective.

In the use of syphons it is necessary that the design be such that air entrapped will be forced out when operation begins so that the siphon is promptly established. It is also to be noted that, unless the air in the loop can be evacuated, the pump will have to operate during the starting period against a maximum static component indicated as D_1—see Case IVb. In some condenser circulating installations, this results in a much higher starting head than the normal operating head and special consideration has to be given to the characteristic of the pump. This can also be true in Case I if P_d is a negative pressure which is not established until after pumping has commenced, as in the case of a barometric condenser.

In systems where there is a variation in some element of the discharge head, it is generally advantageous to establish the discharge head at various capacities and prepare a graph showing the head variation with capacity. When combined with the suction head, the resulting chart indicates the system head.

Specifying Discharge Head

The discharge head, which determines the design conditions for a pump, should be stated with the understanding that is generally composed of static elevation (or pressure) and frictional losses in the discharge piping and that any variations in the static head must be known in order to determine the maximum and the minimum head against which the pump is to operate. Specifying an excessive total head has actually the same effect as specifying excessive capacity. Since a centrifugal pump will always operate at the intersection of its head-capacity curve and of the system-head curve (discussed in the first installment of this series), a pump which develops an excess of head will, unless artificially throttled, deliver an excess in capacity as its curve will intersect the system-head curve at a greater flow.

By breaking up the discharge head into static and friction head, it is easily seen whether the friction losses are excessive. If the piping to be used is too small, the required pump and its driver (motor or engine) will be more expensive than necessary and the cost of operation greater than if the proper size pipe were used. As a rule of thumb, the friction losses *should not be more than* 10 to 20% of the static head for comparatively short pipe lines.

When the total cost involved is high and justifies an extremely detailed

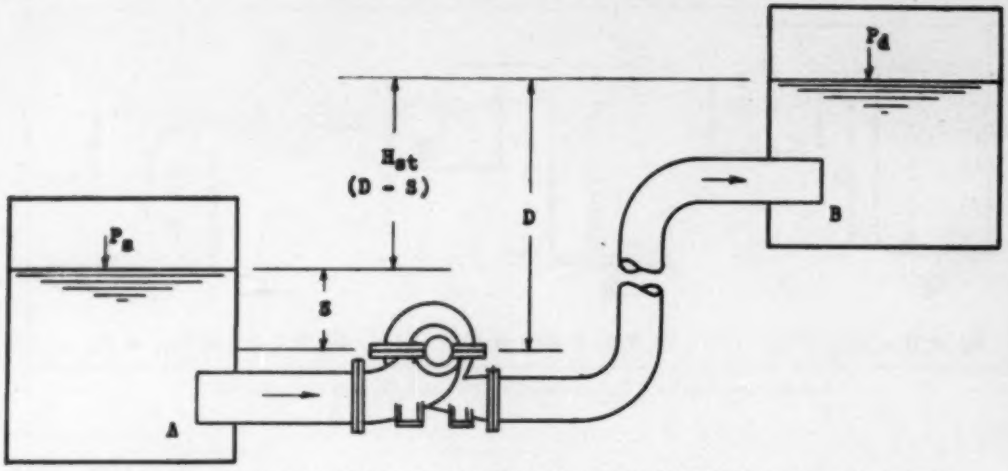


Fig. 11—General Formulas for Suction Head; Discharge Head; Total Head and Available Net Positive Suction Head—NPSH.

FORMULAS

Suction Head	$h_s = S - h_{fs} - h_i + P_s$
Discharge Head	$h_d = D + h_{fd} + h_e P_d$
Total Head	$H = h_d - h_s$
	$= H_{st} + h_f + h_i + h_e + (P_d - P_s)$
(Net Positive Suction Head)	$NPSH = S - h_{fs} - h_i + P_s - P_{vp}$

NOMENCLATURE OF HEADS NOT SHOWN ON DIAGRAMS

h_{fs} = friction head loss in suction line
h_{fd} = friction head loss in discharge line
h_f = total friction head loss from A to B
h_i = entrance loss at A
h_e = exit loss at B
P_{vp} = vapor press. liquid at pumping temp.

(*Some engineers include these losses in h_{fs} and h_{fd}.)

All heads and pressures must be expressed in feet of liquid with proper algebraic signs. Pressures P_s, P_d and P_{vp} can be either in gage or absolute values but, in any case, must all be measured above the same datum.

To convert pressures in psi (pounds/sq. in.) to feet of liquid, multiply by 2.31 and divide by specific gravity of the liquid at pumping temperature.

analysis, it is possible to determine the most economic size of pipe by plotting the sum of the amortization of initial pump, driver and piping cost and operating cost, versus the initial cost and amortization of various pipe sizes.

In certain special applications, the pump may for short periods be required to develop discharge pressures in excess of the design conditions. A typical example is a condenser water circulating pump which is to be installed in a system utilizing a siphon effect (Case I—Fig. 10). The head to be developed consists only of the frictional losses through the piping and through the condenser itself and is therefore of fairly low magnitude. However, in order to enable the condenser circulating pump to deliver water through the condenser, it is necessary to prime the system (in other words, to discharge water over the siphon) and the design of the pump must be such as to permit it to develop a head at shut-off considerably higher than the normal operating head.

Total Head

The total head (Symbol H) of a centrifugal pump is the energy imparted to the liquid by the pump. It is the difference between the discharge head and the suction head. Thus, as a suction lift is a negative suction head, the total head is the sum of the discharge head and the suction lift. If the discharge head and the suction head are not determined independently, the total head can be calculated by determining the algebraic sum of (1) the static head from supply level to discharge level, (2) all friction losses for the capacity being considered, (3) the entrance and exit losses, and (4) the terminal pressure minus the suction supply pressure. For complex systems involving both vacuums and pressure, it is often easier to convert all the various vacuums and pressures into absolute pressure values expressed in feet of the liquid being handled.

When measured by gages attached to the pump suction and discharge openings the total head is the discharge head (the sum of the discharge gage reading corrected to the pump centerline and the velocity head at the point of attachment of the discharge gage) minus the suction head (the sum of the suction gage reading corrected to the pump centerline and the velocity head at the point of attachment of the suction gage). As it is easy to get the plus and minus signs of the various elements reversed, and as there are numerous precautions to be considered in taking gage readings, it is advantageous in any test to follow the instructions in the Test Code of the Hydraulic Institute.

Figure 11 illustrates the heads involved in the calculations of suction head, discharge head, total head and net positive suction head (NPSH).

Total "Dynamic Head" Outmoded

Total dynamic head, dynamic suction head, dynamic suction lift, and dynamic discharge head are discontinued terminology in regular centrifugal pump field. While total dynamic head referred to the same head as is now called total head, dynamic suction head, dynamic suction lift and dynamic discharge head were defined as the heads measured by gage corrected to the pump centerline and thus did not include the velocity head element.

This led to general misunderstanding if the size of the pump suction and discharge openings were not specified

and resulted in different head values for pumps working under identical conditions if their openings were not the same. Furthermore, in determining the total dynamic head from the dynamic discharge head and dynamic suction head it was necessary to correct for any difference in velocity head. The present method of specifying heads is more satisfactory than the "dynamic head" method.

Head Terms for Vertical Wet Pit Pumps

Vertical wet pit pumps may be of the volute type or of the turbine type, the latter covering the propeller type and the vertical turbine pumps, formerly called deepwell pumps. The special problems, both of a hydraulic and mechanical nature, encountered in the vertical turbine pump field has resulted in this type being considered in practically a separate field independent of the regular centrifugal pump field with different practices and terminology.

Both the wet pit pumps of the volute type and those of the propeller type have been handled primarily by engineers in the regular centrifugal pump field. With these two types total head is the discharge head measured at the centerline of the discharge nozzle, with velocity head included, plus the static distance to the suction water level. Thus the loss in the suction bell and those of the suction strainer and suction piping, if either is furnished, as well as the losses in the column pipe and elbow in the propeller type pumps are charged to the pump.

In vertical turbine pump practice, the following head terminology is used by the National Association of Vertical Turbine Pump Manufacturers.

"Laboratory Head" — discharge pressure by gage measured in feet plus static vertical distance to suction water level in a test setup using the minimum length of column and shafting for a laboratory test.

"Total Head"—discharge pressure by gage in feet plus distance to suction water level. (In case of a closed suction, the total head is discharge pressure plus distance to centerline of suction gage minus suction pressure, all being in feet.)

"Dynamic Laboratory Head"—laboratory head, as defined above, plus the velocity head at the point of the discharge gage attachment.

"Total Dynamic Head" — total head, as defined above, plus velocity head at the point of the discharge gage attachment and, in case of a closed suction, minus the velocity head at the point of the suction gage attachment. (What was formerly called "Field Pumping Head" in the vertical turbine pump terminology is now called "Total Head".)

It is regrettable that there is a difference in terminology between the two fields. In most cases of vertical turbine pumps, the velocity head is a very small portion of the head developed by the pump so its omission actually is of little importance.

(The third article of this series on "Basic Factors in the Selection and Application of Centrifugal Pumps" will follow in March or April.—Ed.)

Model State Water Pollution Control Act

The Federal Security Agency, Public Health Service, Division of Water Pollution Control has published a booklet on the *"Suggested State Water Pollution Control Act and Explanatory Statement"*.

The earlier draft of this booklet was reviewed by more than 800 individuals and organizations representative of all the water users in the United States. Later, a committee of consultants, representing the State water pollution control authorities and State officials having a broad background in legislative procedure, evaluated the draft and the comments received. The draft which is now suggested reflects in large measure the views of these individuals.

Ohio Plant Operator Examinations

Examinations for Ohio Operators' Certification in grades "A", "B", and "C" for both water and sewage treatment will be held Friday, April 27, 1951, in five Ohio cities.

Applications to take examinations must be made on forms furnished by the Ohio Department of Health and filed prior to March 17, 1951.

Information regarding certification may be obtained by writing G. A. Hall, Secy., Advisory Board of Examiners, Ohio Dept. of Health, 301 Ohio Depts. Bldg., Columbus 15, O.

WAUKESHA USES MOBILE CRANE EFFECTIVELY

The Water Utility of Waukesha, Wis., is another in a growing list that finds the use of a truck mounted hydraulic crane a great aid in many ways, according to Joseph Kuranz, Asst. Manager. The accompanying photograph shows a Bucyrus-Erie Hydrocrane which has been effectively used for digging manholes, replacing main line valve, handling cast-iron fire hydrants, unloading reinforcing rod from gondola cars, setting derrick sections for pulling pump and well pipe, lifting out well pump motors, as well as many other miscellaneous uses.

According to Kuranz, the unit is excellent for repairing and replacing leaking services from mains into homes, and excavating for leaks avoids hand digging in wet ground and is faster than hand labor. The machine is also being used on excavation work in connection with a main replacement program now in progress.

Florida and Cuban Water and Sewage Assn's Hold Joint Meeting

A Report

by HARRY A. FABER*, *Editorial Associate, Water & Sewage Works,*

Fla. Water Ass'n Officers

Retiring Chmn.
S. Keith Keller
Supt. W. & S.
Pinellas County
Clearwater, Fla.

New Chmn.
S. W. Wells
San. Engr.
State Dept. H'lth
Jacksonville, Fla.

FLORIDA provided perfect weather and the city of Fort Lauderdale supplied perfect hospitality for a Joint Water and Sewage Conference. Held on November 12-15, 1950, the well attended conference included meetings of the Florida and Cuban Sections of the AWWA, and of the Florida Sewage Works Association in the highly adequate Governor's Club Hotel.

All three groups met for two mornings in joint sessions, and the water and sewage groups held separate sessions on two afternoons. The last morning of the conference was devoted to a sightseeing tour and an inspection of the city's water and sewage treatment plants. The city's water supply, derived from 18 wells, is treated in a modern plant employing softening, filtration and chlorination. A high degree of sewage treatment is accomplished by the activated sludge process, and effluent chlorination is provided.

S. K. Keller, Chairman, Florida Section, AWWA, and President, Florida Sewage Works Assn., presided at the first joint session. M. J. Puente, Chairman, Cuban Section, AWWA, presided at the second joint session. The two separate sessions held by the Florida-Cuban AWWA Sections were presided over by Past Chairman W. W. Gillespie and by Vice Chairman S. W. Wells. The two separate sessions of the Florida Sewage Works Assn. were presided over by Past President J. R. Hoy and by Vice President Walter J. Parks.

*Research Chemist, The Chlorine Institute, Inc., New York, N.Y.

The convention committee for the conderence was headed by Charles E. Fiveash, Chairman. Wylie W. Gillespie was Chairman of the committee which planned the program for the meeting. The Club Room where everybody met everybody else was commendably managed by Tom Finley and his special Club Room Committee.

In addittion to a full program of technical papers, the conference included many social events. The City of Fort Lauderdale was host at a cocktail party and dance on the first evening of the meeting; and the three associations held their joint banquet, with entertainment and dancing, at the Bahia-Mar Yacht Club on the second evening. Toastmaster at the banquet was Lawrence H. Daniel, Secretary-

Cuban Section Officers

Chairman
Manuel J. Puente
Cons. Engr.
Havana, Cuba

Secy.-Treas.
Laurence H. Daniel
Pres., L. H. Daniel Inc.
Havana, Cuba

Treasurer of the Cuban Section. Entertainment was provided for the ladies by a committee headed by Mrs. R. G. Heasley, the highlight being an afternoon boat trip up New River on "The Jungle Queen."

Activities of the AWWA, particularly with reference to the effect of the national emergency upon water utilities, were discussed by Harry E. Jordan, Secretary of the Association. Dr. A. P. Black commented on civil defense developments. A review of activities of the FS and IWA was presented by W. H. Wisely, Executive Secretary, who spoke with special reference to service the Federation may supply in problems of industrial waste treatment. Discussion was presented by B. F. Borden, Jr., Director of the Florida Association. Announce-

Fla. Sewage Ass'n Officers

New Chmn.
Walter J. Parks
Cons. Engr.
Reynold, Smith, Hill
Jacksonville, Fla.

New Natl. Director
J. Robt. Hoy
Distr. Mgr.
W & T Co.
Jacksonville, Fla.

ments were made as to dates of future national conventions in Florida: the AWWA is to meet in Miami April 29-May 4, 1951, and the Sewage & Industrial Wastes Federation is to meet there in October, 1953.

New AWWA Section Officers

The Florida Section AWWA, elected the following officers to serve for the coming year:

Chairman—S. W. Wells, San. Engr., State Dept. of Health, Jacksonville

Vice-Chairman—R. F. Brennan, Supt., Water Works, Daytona Beach

Secy.-Treas.—M. R. Boyce, Engineer-Contractor, Clearwater

Natl. Director—C. F. Wertz, Engineer, Water Dept., Miami

Trustees—H. L. Berkstresser, Panama City; C. E. Earls, St. Augustine; George Weigand, Miami; J. L. Burnett, Tampa; J. R. Kelly, Gainesville; H. D. Overhiser, Mt. Dora.

New FSWA Officers

The Florida Sewage Works Assn., at its business meeting, officially adopted the title "Florida Sewage and Industrial Wastes Association." The Association elected the following officers to serve for the coming year:

President—W. J. Parks, Jr., Cons. Engr., Jacksonville

Vice-President—Prof. John E. Kiker, Jr., Univ. of Florida, Gainesville

Secy.-Treas.—Perry M. Teeple, San. Engr., State Dept. of Health, Jacksonville.

Natl. Director—J. R. Hoy, Wallace and Tiernan Co., Jacksonville

Honored by Awards

At the annual banquet of the joint conference, the following awards were presented:

The George W. Fuller Award of the Florida Section, AWWA, to THOMAS PAUL, Supt. of Purification, Bradenton, Fla. for his diligence in improving the operation of the water works of the city of Bradenton. Recognition has previously come to Mr. Paul in his receipt, twice in the past three years, of the operator's award presented annually by the Florida State Board of Health for the best maintained water plant.

Cuban and Fla. AWWA Directors

L. de Goicoechea
Prof. Sanitary Eng.
Havana Univ.
Havana, Cuba

David B. Lee
Chief Engr.
Fla. Dept. Health
Jacksonville, Fla.

(Mr. Goicoechea was voted Fuller Award by Cubans.)

The George W. Fuller Award of the Cuban Section to MANUEL J. PUENTE, Cons. Engr., Havana, Cuba, for his untiring efforts toward the betterment of water supplies of Cuba.

The new A. P. Black Award to that member securing the greatest number of new members for the section to D. W. JONES, Supt. at North Miami, for obtaining twelve new members.

The Arthur Sidney Bedell Award of the FS & IWA, to J. R. Hoy of Wallace and Tiernan Co., Jacksonville, for his long and valuable service as Secretary of the Florida Sewage Works Assn.

Technical Program

Certain papers and discussions are reviewed only briefly in the following report, simply because no one reporter can adequately cover two concurrent sessions.

Problems You Wouldn't Believe

Panel Discussion, "WATER SUPPLY PROBLEMS IN FLORIDA"—Leader, Dr. A. P. Black.

In his brief general remarks concerning the hydrology of Florida, Dr. Black noted that about 90 per cent of the water supplies are derived from wells and 10 per cent from the surface. The only two problems of water treatment *not* encountered in the state are cold water and turbidity. Dr. Black selected the representatives of eleven water treatment plants to describe the variety of different problems presented by as many different water supplies. (The problems, and the solutions devised for them, were so impressive that this discussion proved to be an outstanding event of the meeting. More than one member suggested that a similar panel discussion be planned for the AWWA Conference in Miami in 1951.)

RALPH BRENNAN, Daytona Beach, described his, as the earliest water treatment plant in Florida. Its greatest, and strangest, problem has involved treatment of the water to remove calcium carbonate deposits from the distribution system. Long years ago, "decantation basins" were provided to remove hydrogen sulfide and carbon dioxide from the well water; they did this satisfactorily but resulted in serious incrustation of the water mains.

When the present treatment plant was built, it was decided to dissolve the incrustation by maintaining the finished water at pH 6.6 to 6.8. The pH value and alkalinity of this water increased gradually as it passed through the distribution system (indicating the dissolving of the calcium carbonate deposit). The thick calcite incrustation has now been reduced to a thin coating, and the finished water is now raised to pH 8.9 to 9.0 in order to retain a thin protective coating. Red water results now within three weeks if the pH value is reduced under present conditions.

Honored

Thos. Paul
Chief Operator
Bradenton, Fla.
(Voted Fuller Award)

Dr. A. P. Black
Dept. Head
Univ. of Fla.
(New Black Cup)

J. L. BURNETT, Tampa, has a water supply of highly variable characteristics to deal with: a part of the year large springs provide the major flow of (hard) water; while during the rainy season, surface water provides the major flow of (soft and highly colored) water. The change from hard water to soft water may occur rapidly, but the change from soft water to hard is a slow one. The river is regularly sampled 15 miles above the plant intake, in order to indicate—about three days ahead—the treatment changes which will be required.

Accelerators and settling basins are provided for softening; at times both softening and color removal are required; and at times one-half of the plant is used as a softening plant while the other one-half is used only for coagulation. The algae problem is frequently severe—treatment of the entire river flow is required to combat algae. Though only 25 mgd. of water is required for treatment, the river flow of double this amount at its lowest must be copper treated. Algae growth has been eliminated by the development of water hyacinth, sufficient to cover the water surface; when this was cleared away to aid fishermen, the algae problem returned.

Water & Sewage Secretaries

Perry M. Teeple
Fla. Dept. H'lth
Jacksonville, Fla.
(Fla. Sew. Wks. Assn.)

Marvin R. Boyce
Engr.-Contractor
Clearwater, Fla.
(Fla. Sect. AWWA)

J. R. KELLY, Gainesville, described the problem involved in fluoridation of the softened water supply, derived from deep wells. Local groups advocated fluoride treatment, a city ordinance was passed, and approval of the State Board of Health was obtained. Equipment installed includes an Omega volumetric feeder and dust collector, a zeolite water softener to preclude formation of calcium fluoride, a Rotameter, and stainless steel piping—all at a total cost of $2,657.

Fibre drums are the preferred containers for sodium fluoride as they, unlike barrels, have no paper lining to cause clogging of the feeder. One operator does all the filling operations (with the dust collector in operation) and is required to take a shower bath immediately afterward. The Nile Blue colored fluoride is specified for safe identification. Total annual cost of fluoridation is $3,136—a per capita cost of eleven and one-half cents year.

HAROLD D. OVERHISER, Mt. Dora, has more recently applied fluoridation

to a supply from wells with chlorination as the only other treatment. Many local complaints of changed water quality, all occurring about three months before the actual application of sodium fluoride, proved the most difficult problem to combat. Equipment for this installation includes Hills-McCanna solution feed pumps, a stainless steel solution tank, and Koroseal hose.

HARRY KLINE, Pinellas County Water System, prepared a paper which was read in his absence by S. K. KELLER, Supt. County Water System, Clearwater. This is the only county-owned water system in the state, and Mr. Kline's paper was mainly a historical resume of the thirteen years of its development, particularly of the difficulty in meeting rapidly growing water demands. The water available is highly colored (150 to 400 ppm.) and very soft (pH 5.6 to 5.7), produces a light floc over a narrow coagulation range, and has high concentrations of taste and odor compounds.

Economical treatment, developed after discarding many other methods, is now: using a mixture of 80 per cent lake water and 20 per cent well water, and applying chlorine between the aerator and the filters. Neither silicate nor clay has been found beneficial as a coagulation aid. Taste complaints have been most successfully eliminated by the present point of chlorine application.

EDWIN C. SHREVE, JR., St. Augustine, deals with a hard water obtained from 15 shallow wells. The water must be completely softened and well coagulated in order to accomplish color removal. Softening alone will reduce the original color of 65 down to 35 ppm., or coagulation alone will reduce the original color of 65 down to 20 ppm.

CHARLES A. BLACK, of the Black Laboratories, Gainesville, consultant for the City of Orlando, described the treatment problems at Orlando. Five lakes, connected by concrete coffers, constitute the source of raw water—but the lake water is also used (and then returned) as cooling water by power plants. The floc produced in coagulation is so light that it floats. Effective treatment is provided by the use of activated silica (chlorine-activated sodium silicate) and free residual chlorination. The lake water is high in algae and in tastes and odors. While the addition of alum results in good floc formation, the floc occludes algae and the carbon dioxide liberated from the alum is utilized by algae in rapid photosynthesis. The resultant dissolved oxygen liberated by the algae causes the floc to float.

Solution of this problem depends upon aerating before adding alum, then adding clay followed by activated silica. The floc forms rapidly and must be broken up by high rate operation of the Clari-flow unit; on reformation the floc is dense and heavy—so dense and heavy that it becomes dehydrated as it settles. Surface-type wash water units are provided in the *bottom* of the settling basin, in order to solve the problem of too-compact sludge.

THOMAS PAUL, Bradenton, recited a story of many complex problems—so many, in fact, that they would have exhausted the patience of an ordinary man. His story included unsuccessful attempts to find well water sources, and the decision to treat a creek water—which is really a tidal river and which may change in characteristics overnight. The normal color is 65 ppm., but this creates as much of a problem as a color of 500 ppm. The low alkalinity (10 ppm.) and high coagulant requirement (125 ppm.) produces a jel rather than a floc, but the filters take it out.

Committee Chairmen

W. W. Gillespie
Cons. Engr.
Jacksonville, Fla.
(Program)

T. R. Finley
Finley Supply Co.
Orlando, Fla.
(Club Room)

A new treatment plant was placed in operation in 1950; it provides an Accelator which accomplishes satisfactory floc removal. The taste and odor problem remains unsolved, though prevention by copper sulfate treatment has been found more successful than curative measures.

CLARENCE J. HENRY, Miami, pointed out that Miami is the largest city in the U. S. which softens a supply entirely derived from wells; the average consumption is 60 mgd. The water is very uniform in characteristics, but color varies from 40 to 50 ppm. at the wells and increases to 60 to 70 ppm. at the treatment plant. Taste and odor are almost entirely removed by excess lime treatment; the lime treatment accomplishes the best color reduction at a plus 20 ppm. calcium carbonate concentration.

Free residual chlorination was applied in June, 1949, and accomplishes about 60 per cent further reduction in color (somewhat proportional to the chlorine applied). Final color as low as 7 to 11 ppm. can be maintained. The use of caustic soda was planned, but nitrogen trichloride formation resulted at low pH values, and it was found necessary to maintain a pH of 10.8 to 11.0 in softening when 90 lb. of chlorine per mg. is applied.

J. G. SIMMONS, West Palm Beach, described the problems involved in treatment of a surface water supply of constantly changing quality. A canal is used to regulate the drainage from a 20 mile area, and regular sampling is necessary to predict changes. Coagulation procedure must vary with fluctuation in color, alkalinity and hardness.

R. G. HEASLEY, Fort Lauderdale, reviewed problems involved in the removal of color from a well supply; nineteen wells, of different characteristics, are used in varying combinations; and there are two separate treatment plants. Color (originally 80 to 350 ppm.) is reduced by lime treatment to about 35 ppm. ahead of filtration; chlorine is then used to further reduce color to between 10 and 20 ppm. This supply was the first in Florida to be treated by the application of an activated silica prepared by means of ammonium sulfate. The process satisfactorily accomplishes coagulation and, with less applied chlorine, provides an effective combined chlorine residual.

In reply to a question from L. H. Enslow, Editor, *Water and Sewage Works*, Mr. Heasley explained that the activated silicate not only produced a more effective color-removing floc but also reduced the alum requirement. Dr. A. P. Black added comment on the wide use of activated silica as a coagulant or coagulant aid in the treatment of Florida waters—pointing out that all of the various types of activation are employed in different plants.

CHARLES A. BLACK then discussed the plan, under consideration by the city of Orlando, to install electrolytic chlorine cells to produce chlorine for water treatment. This would not include liquefaction facilities, the chlorine gas being produced in accordance with treatment requirements. The city owns its power plant and electricity would cost seven and one-half mils; the caustic soda produced would be used to replace à part of the lime now used in the water treatment process. It is estimated that chlorine can be produced at a cost of 3½ cents per pound even if no value is assigned

Plant Operator's Panel

J. L. Burnett, Supt. Filtr., Tampa | *C. J. Henry, Supt. Filtr., Miami* | *John G. Simmons, Supt. Filtr., W. Palm Beach* | *Ray Heasley, Supt. Filtr., Ft. Lauderdale*

to the caustic soda; or, chlorine will cost 1½ cents per pound if the caustic soda is valued only at the price of the lime which it replaces. Subject to more detailed investigation, local considerations indicate chlorine production to meet plant needs may be a feasible and attractive undertaking at Orlando with 7.5 mil current.

At the Miami Water Treatment Plant, the value of calcined calcium carbonate sludge is found so profitable that the dollar return from this source is expected to pay for the new lime recovery plant within seven years.

Defense Planning

Panel Discussion, "DEFENCE PLANNING IN FLORIDA"—Leader, David B. Lee, Director, Bureau of Sanitary Engineering, State Board of Health, Jacksonville.

Mr. Lee introduced the discussion by defining the responsibility delegated to the State Health Dept. and its engineering services in planning civilian defense undertakings in the state. All health and medical services are to be under the direction of this department. He emphasized the value of training manuals to provide basic details of plans to operate on local levels. Local officials must take active and responsible part in the application of plans.

HARRY E. JORDAN, speaking of the national situation, showed clearly the essential part which Mutual Aid plans have in the civilian defense picture. Emergency needs necessitate knowledge of inventories and supplies; special legislation may be required to make possible the transfer of equipment between municipalities. He recommended that a special group be established to plan for mutual aid, and that the state be divided into districts for the most effective assembly of inventory material. Means should be prepared, particularly, to assure chlorine supplies by arrangements to borrow from neighbor communities.

Mr. Jordan considers that defense against individual acts of sabotage may be of more concern than large scale protection. The specialized knowledge of certain individuals could effectively damage water and sewage utilities. Legislative action may be desirable to permit local officials to dismiss those employees not completely in accord with the defense effort.

B. F. BORDEN, JR., Director, FSWA, Jacksonville, commented on the actions taken by the Federation of Sewage and Industrial Wastes Association. While the Federation has developed no definite program, it has established a committee to work with officials of State Health Departments. Recognition is given particularly to the need for mutual aid between sewage utilities as much as between water utilities.

J. B. MILLER, San. Engr., State Board of Health, Jacksonville, gave details of the organization of the state's Defense Council, and of the engineering services it is to provide. Regional meetings will soon be held by the Office of Civilian Defense, and local officials will attend after proper clearance has been given.

Fluoridation Treatment

Panel Discussion, "FLUORIDATION"—Leader, S. W. Wells, San. Engr., Bureau of Sanitary Engineering, State Board of Health, Jacksonville.

Mr. Wells described the purpose of this panel discussion as providing a comprehensive review of the water fluoridation situation.

The discussion was opened by DR. A. P. BLACK, University of Florida, Gainesville, who summarized the background knowledge of fluorides in water as the causative agent of fluorosis or mottling of tooth enamel. He described the first announcement of the decay-preventing potentialities of fluoride in water, made at the 1943 meeting of the AWWA in Cleveland. Dr. Dean of the U.S. Public Health service had described desults of epidemiological surveys of communities where the water supply contained varying concentrations of fluoride, and Dr. Ast had proposed experimental studies to determine the effect of artifically added fluoride ion. Since that time important studies have been undertaken by Grand Rapids, Mich., and by Newburg, N. Y. (both in 1945), as well as by other municipalities.

DR. FLOYD H. DECAMP, Bureau of Dental Health, State Board of Health, Jacksonville, reported on the current attitude of medical and dental authorities toward the practice of fluoridation. The practice had received approval by resolution of the House of Delegates of the American Dental Assn., only the preceding week. Florida medical and dental groups are known to approve properly initiated local programs; to date these groups have contributed educational guidance. He cited the editorial "Fluoridation Comes of Age," in *Water and Sewage Works*, November, 1950, as an exceptionally clear statement of the case for fluoridation. He especially liked the idea that fluoridated water deserved a higher rate than ordinary water.

HARRY A. FABER, Research Chemist, Chlorine Institute, New York, summarized materials and equipment available for the operation of fluoridation. He listed types of dry and solution feeders which can be employed,

Plant Operator's Panel

Chas. A. Black, Pres., Black Labs., Gainesville | *Edw. C. Shreve, Supt. Filtr., St. Augustine* | *John Kelley, Supt. Filtr., Gainesville* | *H. D. Overheiser, Supt. Water, Mt. Dora*

as well as accessory devices—such as dust collectors—which may be needed. He reviewed the source materials for adding fluoride ion, together with their cost, handling, solubility and other considerations. The additional equipment required to operate this relatively simple water treatment practice is a laboratory comparator outfit for the determination of residual fluoride.

In closing the discussion, Mr. Wells stated that—to date—the State Board of Health has neither discouraged nor promoted fluoridation. Two communities in Florida are applying fluorides (Gainesville and Mt. Dora); one community has received the approval required to do so (Naples); and the State Board may actively advocate the practice in the future.

Chlorination Up to Date

"CHLORINATION—THE FIRST FIFTY YEARS," was the title of a paper presented by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

He commented only briefly upon the development of early water and sewage chlorination practice, but discussed in detail the present state of knowledge concerning contemporary practices. By means of lantern slides, five important principles and practices were reviewed; these included the reactions of chlorine with water, and with biological and chemical constituents of water; the significance of water pH; the methods of chlorination control (free and combined residual chlorination); and the proper selection of chlorination practices to accomplish specific purposes.

L. H. ENSLOW, programmed discussor of the paper, commented upon the significant part which investigations of "chlorine demand" (made 30 years ago) had contributed to the proper operation of chlorination. He cited examples of the use, in Florida water treatment plants, of the two types of chlorination; free residual chlorination is used at Miami, where the pH value is high after recarbonation; and at low pH value at St. Augustine, where the alum application is 4 grains per gal.; the color-bleaching effect of chlorine is widely utilized in many plants of this state. Particular attention should be given to the need for maintaining higher residual chlorine values at high pH values, because of the marked slowness of disinfection in the alkaline zone.

Water Rates in Cuba

"CUBAN WATER RATES," a Committee Report of the Cuban Section, was the title of a paper read by Manuel J. Puente, Cons. Engr., and Chairman, Cuban Section, AWWA, Havana, Cuba.

Mr. Puente described water works systems in Cuba as of three classes: state, municipally, and privately owned. The history of state ownership is earliest and largest—before 1902, until passage of a constitutional law, no municipality could undertake to issue water works bonds. The central government was responsible for providing water and sewage utilities for the largest cities, but filtration was generally not included; sanitary requirements were seldom enforced; construction did not comply with modern requirements; and the capacity (of treatment and distribution) was not based on future needs. Water rates in state-owned systems are low—because construction costs were borne by the government—and are based only on a division of operating expenses by the number of consumers.

The city of Havana has one of the few municipally owned water works systems, and the rates imposed are sufficient to allow sufficient return to provide a surplus. Plans have been approved to reconstruct this system in line with present requirements.

Under the laws of 1940, municipalities may make grants to private water systems. The private owners must secure approval of rates by the national Public Service Commission, and only rarely will the Commission approve rates higher than those obtaining for governmental systems. Hence, water rates in Cuba are roughly one-half the rates typical of the U. S. The cost of Cuban water works construction and of power for pumping is about 40 per cent higher than U. S. costs. Thus, it becomes very difficult for private owners to improve service or modernize works until rate increases are granted.

The Future in Water Supply

"WATER SUPPLY TODAY AND TOMORROW" was the title of a searching talk to waterworks men by Linn H. Enslow, Editor, Water & Sewage Works.

Mr. Enslow stated that waterworks men might not like some of the things he would say in his "sermon," which would be based on what he considered shortcomings in the water supply business. These, sooner or later, would have to be corrected if the water utility was to be accorded the prestige which it rightfully should have in the eyes of the general public and the financial and legal fraternity.

Starting with rates, both financial and legal interests had a right to question the soundness of the water supply business when it is a fact that water rates have little or no similarity of pattern when comparing publicly owned systems of various communities. Regardless of the fact that comparisons have been made of rates charged by water departments of comparable size, number of customers, capital investment, power costs, etc., the picture reveals a pattern of expediency in charging for water service, rather than any scientific basis. It seems apparent that what is sorely needed in the publicly-owned water utility field is more standardization and regulation by State Utility Commissions such as exists in Wisconsin and Maine, and to a limited degree in some other states. In these states where rates and financing are regulated in public as well as in private water utility operations the publicly-operated systems are on the whole the best operated and the least concerned over finances and adequate pay for employees, and are happily operated at a fair profit return. Political interference is almost non-existent under state regulation, since most publicly-owned utilities are operated by local Boards of Commissioners in a business-like fashion. In water departments, as a rule, the ratio of income for fire protection as compared to income from water sales is away out of balance. This deficiency is quickly detected by financial agencies and creates a low regard for management, even though it is recognized that the manager is up against political overlords who too often follow the dictum of expediency rather than adopt sound business principles.

Rates and rate-making is thought to be on a more unrealistic plane than any other part of water utility management and operation. To merit prestige, and to effect a profitable utility business, water works men owe it to themselves to get busy and correct this deficiency, looking toward a "tomorrow" in the water supply business. It is good to see that the American Water Works Association is now strenuously and commendably tackling this problem through its energetic Committee on Rates and Rate-Structures. It will be up to water works managers to put into practice the recommendations of this committee and establish prestige for the industry.

Another increasingly serious shortcoming of the water supply business, and one which is too prevalently on the increase is that of pleading insufficient water, lack of main capacity, or what not, to be able to give the customer the quantity of water which he is ready, able and willing to pay for. Restrictions on water use and hours of use are bringing to the water util-

ity business the worst kind of public relations status, and lowered prestige. Mr. John Q. Public is not asked by the electric or the gas utility to forego use of electricity or gas. He naturally must ask himself why it is that the water utility lacks the ability to supply his water requirements. The natural conclusion is that it is a city-run and inefficient operation with short-sighted management and lack of planning that is responsible. Possibly there could be some truth in this if certain cases were examined from the bottom up. Perhaps the water works industry got into the habit of accepting shortages in World War II and haven't gotten over this handicap since. It is high time, however, that a new perspective is taken on.

It is not believed that the public will continue much longer to accept water shortages year after year without taking active measures to learn why. There is but one ray of light which this situation creates. Water shortages may well bring on public demand for state supervision and regulation of the water supply business. Mr. Enslow said "ray of light" because, from observations in Wisconsin and Maine, such state regulation had greatly benefitted publicly owned water utilities all along the line, from top management down to the man in the trench.

Another deficiency in water utility operation and management is the method of charging for water main extensions. It is no less than phenomenal to find such a variety of methods of financing water main extensions to new users. Little wonder that the financial and legal fraternity find it hard to understand the heterogeneous patterns used by various publicly-owned water utilities in financing water service extensions, charges for connections to the mains and the like. Little wonder that this situation has been criticized by the American Municipal Assn. and by the American Soc. of Planning Officials. Some standard pattern for financing main extensions is sorely needed and should be pressed by water works men if any semblance of good business management in publicly-owned water systems can be claimed, and if prestige is to result. The Am. Water Works Assn. has provided a guide in making and financing main extensions in its committee report on "Water Main Extensions" published in the August, 1949, Journal—but, far too few have followed the recommendations in the report. Instead, the policy of expediency or favoritism prevails to an unhealthy extent.

Mr. Enslow covered other lesser deficiencies in water utility operation, including methods of charging for water supplied customers in suburban areas at a variety of rates above those charged within the city limits. All that seems to be needed are a few court tests of the legality of many of these super-charges for water delivered across an imaginary line on the edge of the city to bring about a more supportable method of arriving at suburban water rates. An examination of suburban rates reveals that no standardized pattern exists in the establishment of such rates, either through water utility financed mains or those paid for by the new water takers, who are later required to sign over the mains to the water department.

On the Veranda, Governor's Club Hotel

(Left) The Jordans and Enslows of New York and the Miami Glass'.
(Center) Mrs. Tom McCreery; Mrs. Marvin Boyce; Mrs. Percy Black.
(Right) Wives of Cuban delegates, left to right, Mrs. Garcia-Montes; Mrs. Manuel Puente; Mrs. Lawrence Daniel; Mrs. L. de Goicouchea; Mrs. Luis Radelat.

Programmers

Dr. F. H. DeCamp, D.D.S., State Dept. of Health, Jacksonville

Jose Garcia-Montes Consulting Engr., Havana

J. E. Fitzgerald, Engr., Bird Machine Co., So. Walpole, Mass.

In short, said Mr. Enslow, all of these deficiencies and others touched upon, including nuisance charges, must be remedied in this day of revised thinking or expect public demand for water utility "reorganization" and state supervision and regulation as the correction.

Space limitation prevents the printing of the extended discussion following Mr. Enslow's *critique* of the water supply industry's outmoded policies and practices.

Pulp Mill Effluents in Florida

"Dilution Disposal of Pulp Mill Effluents in Florida," was described by Harry W. Gehm, Technical Advisor, National Council for Stream Improvement, Inc., New York, N. Y.

Dr. Gehm pointed out that over 90 per cent of the total pulp production is manufactured by the kraft process, and all of the six kraft mills in Florida are so integrated that both paper and board are produced at the mill. Modern recovery plants, such as those provided in the Florida mills, exceed an efficiency of 95 per cent in recovery of cooking chemicals or burning of evaporated spent cooking liquors. The waste residues are small, but the volume of waste water is high and the total pollution load is appreciable. It is fortunate that, except for two small streams and one inland tidal waterway, large volumes of dilution water are available; the mill wastes cannot be detected very far from the point of discharge.

The result of a cooperative study, made by the Florida State Board of Health and the National Council for Stream Improvement of the Pulp, Paper and Paperboard Industries, illustrates the mixing of pulp mill effluents with receiving waters. By means of lantern slides, Dr. Gehm showed that a different dilution pattern exists in every instance. Considerable progress has been made by the mills in reducing the extent of the affected area, and thus limiting the pollution almost exclusively to unused shallows. Future use of available dilution will be planned to utilize rapid dispersion of the waste and to restrict unusual discharges of pollutants.

Waste Treatment by Flotation

"Industrial Wastes," was the title of a paper by John E. Fitzgerald, Chem. Engr., Bird Machine Co., South Wampole, Mass.

Mr. Fitzgerald dealt largely with the difficulties inherent in the design of a completely new process for treatment of industrial wastes. Slides were used to illustrate developments of equipment and the series of improvements required before it became successful. The flotation equipment discussed is operating at the soap manufacturing plant of Proctor and Gamble Co., Quincy, Mass. It has been described in the June, 1950, issue of *Water and Sewage Works*. The operating results accomplish both

recovery of valuable soap materials and reduction of the pollution load.

Sewage Problems of a Cuban City

"MARIANAO SEWAGE PROBLEMS," were described in a paper presented by Jose Garcia Montes, Consulting Engineer, Havana, Cuba.

Mr. Montes described the city of Marianao as a suburb of the city of Havana; the largest and best portions of the residential sections of the Capital city, the bathing beaches, and the elaborate gardens are located in Marianao. While a single ocean outfall adequately disposes of the sewage of Havana (because of deep water and favorable currents), two disposal plants will be required by Marianao, as pumping costs would be too high for one treatment plant to serve adequately.

Provision of sewerage systems for larger cities is a concern of the central government. Unless the government will pay 60 per cent of the capital requirements, the cost of installing adequate sewerage and sewage treatment will be beyond the ability of the city of Marianao to finance. Drainage creates a particularly difficult situation at present, and the government is planning to correct the problem where conditions are most severe. A complete sewerage system and the two sewage treatment plants present a financial problem difficult to solve.

Waste Treatment Panel

Presiding over a panel discussion of "SEWAGE AND INDUSTRIAL WASTES" was John W. Wakefield, San. Engr., Florida State Board of Health. The national picture was described by W. H. Wisely, Executive Secretary of the FS & IWA; a review of sewage treatment plants and research was presented by Prof. John E. Kiker, Jr., Univ. of Florida; the handling of the citrus wastes problem in Florida was described by Dr. R. R. McNary, Florida Citrus Commission; and John E. Fitzgerald commented on applications of the flotation process of waste treatment.

"THE COSCULLELA PROCESS FOR TREATMENT OF RUM DISTILLING WASTES" was the title of a paper prepared by Engineers Leandro de Goicoechea and Luis Redelat, Havana, Cuba. An English translation of the paper was read by L. H. Daniel, Secy.-Treas. of the Cuban Section.

Water Main Cleaning

A film titled "TRENTON CLEANS ITS WATER MAINS" was presented through the courtesy of J. A. Frank, National Water Main Cleaning Co. Considerable discussion and questions followed.

WATER QUALITY AND TREATMENT

AWWA Manual Now Available in 2nd Edition

After several years of hard work by many contributors, the 2nd edition of the AWWA Manual—"*Water Quality and Treatment*"—is now available. Vastly enlarged and completely rewritten, the 450 page book was really begun in 1943 when the Water Purification Division of the AWWA established a revision committee under the leadership of A. Clinton Decker as Chairman. Twenty-eight members participated in redrafting and writing the several chapters. This work was completed in late 1947 and the material placed in the hands of "Dr. George E. Symons, Managing Editor, *Water & Sewage Works*, for editorial coordination. This phase was finished on Jan. 1, 1949, and the revised material returned to the original authors for restudy and corrections, after which Eric Johnson, Editor of the *AWWA Journal* put the text in order for the printer. Mr. Johnson's work has made the final product highly readable as well as useful as a text for students.

Of the 28 men who participated in the original writing of the text material, four are no longer living: Clinton Decker, Cecil Calvert, Ray Goudey, and Charles P. Hoover. The first three had passed away before the introduction was written last September and the book is fittingly dedicated to them, all three of whom were active not only in writing their own sections but also in the critical study of other sections of the book.

"Water Quality and Treatment" contains in its 2nd edition, 17 chapters and 4 appendixes. These chapters cover: Source characteristics, Organisms, Pollution and self-purification, Reservoirs, Aeration, Coagulation, Sedimentation, Disinfection, Taste and Odors, Filtration, Corrosion, Softening, Iron & Manganese, Steam Generation, Fluoridation and Plant Control.

The book represents the best thinking of experts on the subject in the field of water purification. Perhaps its one fault lies in the slowness with which it appeared, thus making some of the material a bit dated by the time the book was published on Dec. 15, 1950. This criticism cannot be made of all sections of the book, for portions of the text relating to disinfection, odor removal and fluoridation were repeatedly revised even up to galley stage in order to keep step with the rapid advances in technology. Other sections too are no older in their presentations than late 1948 or early 1949, and considering the enormity of the job, this situation is to be expected.

Persons familiar with the first edition will notice other changes besides the rather extensive increase in number of pages. The book is understandably sectioned in each chapter and the system of numbering the sections in each chapter is adhered to throughout the book. In the 2nd edition, each chapter has its own bibliography and all references are clearly marked. One of the biggest chores of preparing these bibliographies was the searching out of the original reference made in the first edition but not recorded as to where it was published. Persons interested in such phases of the history of water purification development will have no trouble in this edition in finding the source for any important statement made.

As one of the appendixes, there is included a list of books in the "Water Supply Library." This list covers practically everything of interest and importance in such general fields of study as water supply and treatment, engineering and technology, and administration and management. The AWWA Code of Practice is also included as an appendix. Appendix three contains a list of Chemicals Used in Water Treatment. This extensive table contains information on chemical name and formula, common or trade name, available forms, weight per cu. ft., solubility, and characteristics, etc. Forty-seven chemicals are included in the list. This table was developed from a combination of a similar table prepared by H. Munroe, and published in *Water & Sewage Works*, and a table prepared a number of years ago by the ASCE.

From the opening chapter on Characteristics of Available Water Sources to the final chapter on Treatment Plant Control, this book represents the best and latest information on the general subject of water quality and treatment. It should be in every engineer's and superintendent's library. It may be obtained from the AWWA, 500 Fifth Ave., New York City 18, N.Y., for $5.00 per copy.

Improved Apparatus

For Determining Organic Nitrogen

by D. B. WILLIAMS, *Sup't., Water Purification, Waterworks Laboratory*
Brantford, Ontario

"STANDARD Methods for the Examination of Water and Sewage," 9th Ed., does not completely describe the apparatus for use in determining the free ammonia and albuminoid nitrogen apparently presupposing that the analyst will employ the apparatus supplied under the description of "ammonia distillation apparatus."

The writer has followed N. J. Howard[a] in finding the apparatus shown in the accompanying illustration to be more convenient for this work.

"Standard Methods" does not mention a Kjeldahl flask in the determination of total organic nitrogen in water but does leave the thought that this determination may be performed in whatever apparatus is used for free NH_3 determination. The procedure does mention digesting under a fume hood giving the impression of a partially disassembled apparatus with only flask and contents taking part in the digestion, the necessity of a fume hood, size of which limits number of samples examined at any one time, the long period operation of a usually noisy fan and the production of sulfuric vapors with attendant corrosion problem.

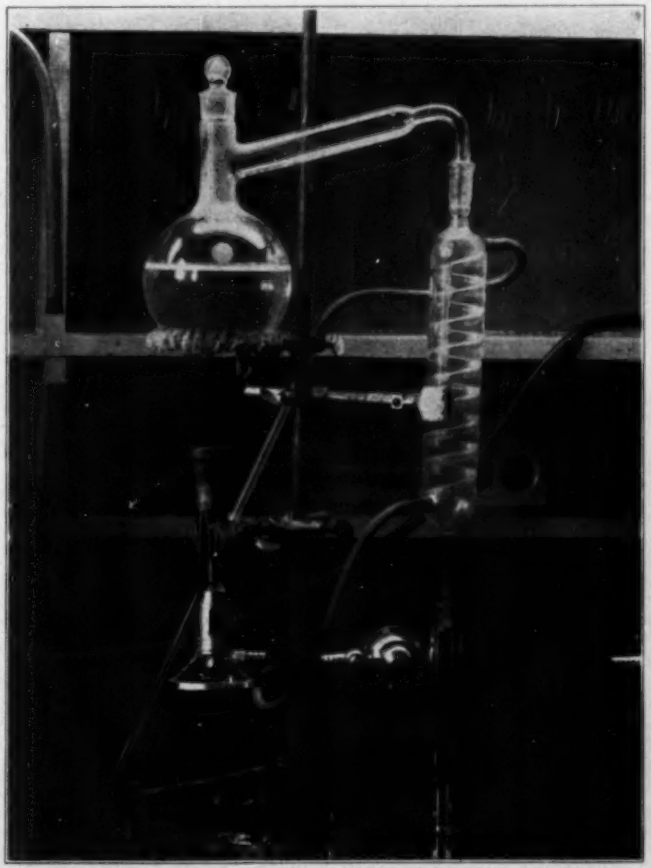
The Kjeldahl method may be performed just as accurately in the apparatus shown in the illustration with none of the inconveniences listed above. If the sulfuric digestion is carried out with flask and condenser connected as shown a fume hood is not required, no acid vapors will enter the atmosphere and only distilled water boiled off during digestion requires disposal.

The glass apparatus is Corning No. 3360. Interchangeable ground glass joints minimizes replacement costs. The stopper and joint are lubricated with a silicone grease. The flask may be obtained in a number of sizes but it would appear that the 1000 ml. size is most suited to water samples. 500 ml. samples are suggested.

The flask is not held by a clamp but rests on a ring support and on the condenser, facilitating handling. The ring support is wound with asbestos rope to prevent contraction of the ring from cracking flask. "Boiling chips" should be used in all determinations. Crushed firebrick or any other ceramic material that has been well fired to ensure no organic content is suitable. The flame makes direct contact to glass.

Procedure

Assuming that it is desired to determine both free NH_3 and organic nitrogen proceed with the apparatus shown in the normal way for free NH_3. With no apparent loss in accuracy time may be saved by replacing the "boiling out of free NH_3"



Apparatus for Determining Organic Nitrogen in Water, Industrial Wastes and Sewage
(After Howard[a])

[a]N. J. Howard, Director of Purification, The R. C. Harris Filtration Plant, Toronto, Canada.

from the apparatus by flushing of the apparatus thoroughly with NH_3 free distilled water or some of the sample. Some NH_3 free distilled water should be poured through the condenser.

Following the free NH_3 distillation and determination the remaining residue must be cooled prior to adding conc. H_2SO_4 for digestion, otherwise violent reaction results. The flask and contents may be permitted to cool naturally or may be cooled under a tap but by preference the author adds the 10 ml. of conc. H_2SO_4 to 100 ml. of NH_3 free distilled water and then adds this dilute acid to the hot residue without difficulty.

Cu SO_4 is added and the digestion is carried out in complete accordance with "Standard Methods." During digestion a beaker is required to catch distilled water from the condenser but no acid vapors will leave the apparatus.

Following complete digestion, permit the flask and contents to cool to touch. Then remove flask and while holding stopper in place flush NH_3 free distilled water back into the flask via the outlet end of the condenser arm by means of a wash bottle, holding the flask almost upside down for this operation. Stand flask upright on bench, approximately half filling with NH_3 free distilled water. Add 18 grams Na OH pellets (more or less as indicated), swirl to dissolve Na OH. Check with one drop of Phenolphthalein to assure that sample is alkaline. Flush condenser with NH_3 free distilled water. Replace flask on ring support and condenser, then proceed with the alkaline distillation nesslerizing the distillates in the normal manner.

Comment

Should the free NH_3 content be not desired it is still necessary to remove the free NH_3 content prior to sulfuric digestion requiring distilling off of approximately half of sample volume. In this case the distillate is discarded rather than nesslerized.

On flood waters high in organic turbidity it has been found necessary to increase the amounts of H_2SO_4 and Cu SO_4 used, increasing the Na OH correspondingly. Under such conditions the value of "boiling chips" is particularly apparent. Only on two occasions has it been necessary to use K_2SO_4 to raise digestion temperature. Careful checks were made by the author to assure that none of the practices suggested above will depreciate accuracy. The apparatus shown has been used for 1½ years in determining organic nitrogen by Kjeldahl method.

All reagents used are those of "Standard Methods," 9th Ed., since this suggestion is purely one of apparatus selection and handling.

A very satisfactory grade of NH_3 free and Cl_2 free distilled H_2O may be made in fair volume by distilling ordinary distilled water in the presence of 10 ml. conc. H_2SO_4 in the 2000 ml. size of the apparatus shown.

John Bumstead Becomes Asst. Dir. Ohio River Compact

Announcement has been made by Henry Ward, Chairman of the Ohio River Valley Water Sanitation Commission of the appointment of John C. Bumstead as Assistant Director. For the past several years, Mr. Bumstead has specialized in reporting new developments in the field of water sewage and waste treatment as an associate editor of *Engineering News Record*. In that capacity he has written widely on the stream sanitation activities in the eight states signatory to the Ohio River Compact.

Prior to his editorial work, John Bumstead was a lieutenant colonel in the Army Sanitary Corps. In 1943 the army assigned him to a three year tour of duty in the Rio Doce valley in Brazil as chief engineer of an inter-American sanitation unit. There he built water supply, sewage works, and hospital facilities as well as aiding in the promotion of an education public health campaign to insure maximum labor production from iron and mica mine operations.

Before entering the army, Mr. Bumstead was an assistant field engineer on the staff of the Tenn. Valley Authority and from 1935 to 1941 he was assistant city engineer of Saratoga Springs, N.Y.

Mr. Bumstead is a graduate of Rensselaer Polytechnic Institute, a registered professional engineer, and a member of ASCE, APHA, AWWA, APWA and the IAASE. In his new position he will serve as assistant to Edward J. Cleary, Exec. Director and Chief Engineer, and he replaces K. S. Watson who resigned last fall to enter the employ of the General Electric Co.

M. W. Edwards Joins Wertz Engineers of Reading

Announcement has been made of the appointment of Myles W. Edwards to the Industrial Waste Treatment and Purification Staff of the Wertz Engineering Co., of Reading, Penn.

Mr. Edwards has until recently, been Principal Chemist with the Bureau of Engineering, Penn. Department of Health, handling Industrial Waste Treatment in ten counties, including the Reading area.

Mr. Edwards has had varied experience in water purification and industrial waste treatment over the past thirteen years, five of which were spent with the Pennsylvania Department of Health, and eight with Scranton Spring Brook Water Service Co., at Wilkes-Barre, Penn.

R. F. (Daredevil) Brown Is Dead

R. F. Brown, Superintendent of Sewer Maintenance for the City of Los Angeles for the past seven years, died at his home in Paradise, Calif., at the end of November, but the news reached us too late to be included in our January issue. "Rube" as he was familiarly known to many of his friends was nicknamed "Daredevil" by this magazine when he made a tour of several miles of the large outfall sewer of the city a number of years ago. As a result of that inspection, and subsequent report, thousands of dollars were expended for repair.

Mr. Brown had been with the city for 27 years and because of ill health had been on leave of absence during the past year. He was well known not only to readers of this magazine through his articles, but through his activities in the Federation of Sewage Works Assns., his reports on sewer maintenance, and his study of salary schedules. He was 59 years old at the time of his death.

Settling Tank Design

Comments and Criticisms of the Article by F. Poepel*

IN the October 1950 issue of *Water & Sewage Works*, there appeared an article on "Settling Tank Design" written by F. Poepel of Stuttgart, Germany, and translated by C. E. Keefer, Deputy Sewerage Engineer, Baltimore, Md. Unfortunately, there were a number of typographical errors in the printed article. These were first called to our attention by Prof. H. M. Gifft of Cornell University, who aided in the preparation of a set of corrections, which were published on page 523 of the December issue.

Prof. Gifft also called attention to what he considered errors in the logic and conclusions of the original article, and the editors asked him to submit a formal discussion of the paper. Copies were submitted to the translator and the original author and other interested persons. Because of the time limitation of a publishing schedule, it was impossible to give the author a chance for rebuttal or to obtain other discussion (if such were forthcoming) in time to publish all of the material in the December or January issues. Hence it was necessary to delay publication of the following discussions of that article until this issue. We trust that readers interested in this topic have not been too greatly inconvenienced by the delay in publishing both the correction and these discussions.—The Editors.

Comments

by HOWARD M. GIFFT, *Professor of Sanitary Engineering, Cornell University, Ithaca, N.Y.*

This writer is of the opinion that in the original article by Prof. Poepel there are certain errors of more serious nature than the typographical corrections published in the Dec. 1950 issue. Some of these errors may have been introduced in translation, others (in the writer's opinion) are errors of fundamental nature, i.e. errors of approach to the subject and errors in conclusions.

Laminar and Turbulent Conditions

In the first part of Prof. Poepel's article there are a number of references to laminar and turbulent "flow." These references are at least misleading if not altogether incorrect. For example, in the first column of page 422 (Oct.) immediately following equation (4) it says:

"Equation (3) applies where flow is laminary and equation (4) where it is turbulent. Another general equation suggested for the settling velocity of mineral material in liquid is

$$s = c.d^x \quad (5)$$

The value of x can be taken as 2 for laminary flow and 0.67 for turbulent flow."

As the words "laminar flow" and "turbulent flow" are used by Prof. Poepel, the implication is, that there is a flow of sewage through some sort of settling basin, whereas the equations and the discussion are referring solely to the settling of a particle. Therefore, Prof. Poepel must mean that *settling* conditions for the particle are laminar or turbulent and not that flow (in a tank) is laminar or turbulent. Substitution of the word "settling" for "flow" in the above quotation will correct the statements.

In column two of page 422 (Oct.), the article states:

"In grit chambers the settling velocity of suspended solids with a diameter greater than 0.33 mm. can be determined in the laminary zone by equation . . . (9)".

In this statement, Prof. Poepel *must* mean *turbulent* instead of laminary because equation (9) derives from equation (4) which is for turbulent settling. The reference to laminary before equation (10) is correct, however, because equation (10) derives from equation (3) which is for laminary settling.

In connection with the discussion of equations (9) and (10) it is well to point out that there has been an unfortunate choice of words when reference is made to laminary "zone". Actually when speaking of settling velocities for particles as indicated in equations (9) and (10), Prof. Poepel is referring to particle settling, or in other words, a certain "range" of Reynolds' number values in which values the velocity and diameter is for the settling velocity and diameter of the *particle*.

It seems to the writer that any reference at all to turbulent settling is misleading, because practically all particles, *which are of interest*, in grit chamber or settling tank design, settle well within the laminar range as described by Reynolds' number. Prof. Poepel, too, must have recognized this fact, for he never again considers equations (4) or (9) which refer to turbulent settling. Incidentally, although particles settle within the laminar range *flow* through any sedimentation basin is practically never laminar according to Reynolds' Number values.

Horizontal Movement Influence

On page 423, column two under the subheading *"Horizontal Movement Exerts but Little Influence"* it says "Experience indicates that the horizontal movement of water in a settling tank exerts no influence worth mentioning on the settling of suspended material."

This is a perfectly valid statement but whether or not "experience" indicates the true facts is another matter. Camp's[1] excellent article on sedimentation offers the possibility that this may not be true. Be that as it may, Prof. Poepel assumes the statement to be correct, and bases the remainder of his article, directly or indirectly, on this assumption, by using equation (15) in subsequent derivations. However, Prof. Poepel seems to contradict himself in the same paragraph when he says:

"If the velocity in a settling tank is doubled, only suspended solids 1.414 (the $\sqrt{2}$) times as large will be removed."

Relation of v to d

The unnumbered equation in column two of page 423

$$d = \sqrt{\frac{h}{lc}} \times \sqrt{v}$$

is mathematically correct but it very misleading.

The inference is that any change in v, no matter how the change is brought about, will cause a change in d. In fact, the statement that "If the velocity in a settling tank is doubled, only suspended solids 1.414 (the $\sqrt{2}$) times as large will be removed" says just that. Unfortunately, such a conclusion is not correct because v is *not* independent of the other variables in the equation.

*Translated by C. E. Keefer, Water & Sewage Works, p. 422, Oct. 1950; Corrections published, p. 523, Dec. 1950.

Up to this point, Prof. Poepel has not introduced the physical concept of velocity in his discussion. He has used v only in a geometric way and it is nothing more than a collection of the fundamental variables q, b, and h and the equation should be

$$d = \sqrt{\frac{h}{lc}} \sqrt{\frac{q}{bh}}$$

The numerical value of v can be altered in various ways. If the alteration in v is accomplished by varying b, then Prof. Poepels statement *is* correct, *but* if the alteration in v is accomplished by varying h, then the statement is incorrect, because h cancels out.

In other words, a change in d is not brought about by changing the dependent variable v, but by changing a fundamental variable such as b. The value of d can also be changed, of course, by altering any of the other fundamental variables l, q, or c. It is therefore incorrect to say that "if the velocity in a settling tank is doubled, only suspended solids 1.414 (the $\sqrt{2}$) times as large will be removed."

This same unnumbered equation apparently is also responsible for the statement in this same section that "it is obvious that the ratio of length of tank to its depth should be increased". Again the inference is that a change in the numerical value of $\frac{h}{l}$, however brought about, will cause a change in the value of d. As in the case of v, illustrated above, a change in the value of d will result *only* if the variation in $\frac{h}{l}$ is brought about by varying l because, also as before, h cancels out. It is, therefore, also incorrect to say that "the ratio of the length of a tank to its depth should be increased" in order to collect smaller particles.

Concept of Surface Area

Actually the equation should be

$$d = \sqrt{\frac{q}{blc}}$$

and it is only by mathematical trickery that either v or $\frac{h}{l}$ can be shown to have any effect on the value of d. The equation in its correct form will be recognized as nothing more than the surface area concept of settling tank design as $\frac{q}{bl}$ is nothing more than the "overflow rate" or "settling rate," commonly expressed in terms of "gallons per day per square foot" in this country.

Up to this point Prof. Poepel has not properly introduced any concept other than that of surface area. He does, however, propose something different in equation (21) although it hardly seems logical that "the *lack* of exhaustive experimental results" should warrant the conclusion that $\frac{vd}{s}$ should be a constant. No basis for such a conclusion is given but it apparently came from the section headed "Grit Chamber Dimensions," and from Table 2, in which $\frac{vd}{s}$ (which equals $\frac{bd}{h}$ always has the value of 1.75 mm.

But the fundamental objectives of a grit chamber are vastly different from those in a settling tank. In a grit chamber the attempt is made to collect all particles with a certain "settleability" but deliberately to *maintain in suspension all other particles so that they will pass through the chamber.*

In a settling tank, there is no reason whatsoever to alter the cross-sectional flow, that is, the velocity, in order to *prevent* any material from settling. What's more, if Poepel's basic equation (15) is correct and if experience does indicate "that the horizontal movement of water in a settling tank exerts no influence worth mentioning on the settling of suspended material", then the horizontal velocity has no effect on settling velocity, and there is no reason for one to vary with the other.

This conclusion that $\frac{vd}{s}$ should be a constant is, in reality, the only proposal which is different from the present relatively standard practice for settling tank design and it is only by the introduction of this constant, c', that h in equation (25) can have any real value. It may be that $\frac{vd}{s}$ should have a specific value based on the characteristics of the material to be settled, but Prof. Poepel offers no reason whatsoever to bear this out. In fact, the conclusion reached from an attempt to evaluate this constant would indicate that such is not the case.

Poepel's Conclusion

Poepel's conclusion that final tanks should be twice as deep as primary tanks was reached from a consideration of the derived equations and is based *only* on the "especially favorable clarifying ability" of the Paris-Acheres primary tank installations and the Amsterdam-West secondary tank installation. These tanks had settling velocities, or overflow rates, of 1300 and 1180 gpd. per sq. ft. and diameters of 115 and 54 feet, respectively.

Because the R/h ratios were 5.3 and 2.75 respectively, Poepel reached the conclusion that primary tanks should be half as deep as secondary tanks, even though the tanks he considered in order to arrive at this conclusion had actual depths of 10.8 and 9.8 feet, respectively.

But the surprising thing is that if the Paris-Acheres tanks had been 54 feet in diameter instead of 115 feet, and the Amsterdam-West tanks had been 115 feet in diameter instead of 54 feet, Professor Poepel's analysis would have indicated that primary tanks should be *twice* the depth of secondary tanks, just the opposite from what it did. In other words, the introduction of this constant value c' and his method of arriving at its value will indicate a desirable relationship between depths of primary and secondary tanks approximately in inverse proportion to the diameters *of any two tanks examined.* Obviously, there must be something wrong with the analysis.

In the next to the last paragraph of the addenda Poepel states that because the "corresponding equations . . . . . have in principle exactly the same form . . . . . rectangular tanks will have the same clarifying efficiency as circular ones if $n = \frac{1}{\pi} = 0.318$."

Such a statement is completely without foundation. According to equations (27) and (30) the size of particle retained in a tank is dependent on q, c and the surface area of the tank, or

$d = \sqrt{\frac{q}{c \pi R^2}}$ from equation (27) and

$d = \sqrt{\frac{q}{cbl}}$ from equation (30)

In other words the efficiency of rectangular and circular tanks should be equal if $\pi R^2 = bl$.

The equation $n = \frac{1}{\pi}$ is obtained by combining equations (27) and (30).

From $\sqrt{\frac{q}{cd^2}} = \sqrt{\pi} \times R$, equation (27)

and $\sqrt{\frac{q}{cd^2}} = \frac{1}{\sqrt{n}}$, equation (30)

$$\sqrt{\pi}\, R = \frac{1}{\sqrt{n}}$$

This equation says nothing more than that for R and l to be equal (or R/h to equal l/h), n must have a value of $\frac{1}{\pi}$. Relative efficiencies do not come into the reasoning in any way unless one assumes, as Poepel does, that R/h and l/h values have some influence on settling tank efficiencies. In any case, there is no reason to conclude that *all* values of n, either greater or less than $\frac{1}{\pi}$, would cause

rectangular tanks to be *less* efficient than circular tanks. Since the equations "are of the same form", plotted values should cross at a certain point (where $n = \frac{1}{w}$) and efficiencies would be *greater* on one side and *less* on the other side of this crossing. In fact, if R/h and *l*/h values are important, the efficiency of a rectangular tank could be improved by increasing *l*, which in turn would make the value of n greater; this is exactly the opposite of Poepel's conclusion "that radial-flow circular tanks will have a greater clarification effect than rectangular tanks with the same surface area."

There have been many articles written on the subject of sedimentation over the past years, a number of them arriving at conclusions equally as illogical as Prof. Poepel's. With the publication of Camp's[1] classic article, it was the writer's hope that the fundamental concepts included would be the basis for future thinking and development of the art of settling tank design. Apparently such has not been the case.

(1) T. R. Camp, "Sedimentation and the Design of Settling Tanks," Trans. A.S.C.E., Vol. III, 895 (1946).

A Protest

by J. E. McKEE, *Assoc. Prof. San. Engr. and* A. C. INGERSOLL, *Instr. in Civ. Engrg.*
California Institute of Technology, Pasadena, Calif.

In preparing this protest and rebuttal to Prof: Poepel's artitcle on "Settling Tank Design," the writers have had the opportunity to review the comments by Prof. Gifft. It is our belief that this criticism does not conflict or overlap Gifft's comments but rather abets and compliments Gifft's discussion.

When there appears in print an article so simple in its presentation, so elementary in its concepts, and so positive in its conclusions, it is read, believed, and adopted by many busy designing engineers. Adoption is encouraged and hastened when the concepts and conclusions are converted into a handy nomograph. However, if the article contains inaccuracies and misleading conclusions, it may cause misconceptions in the minds of many engineers and possible result in faulty designs. Such an article is the one entitled "Settling Tank Design" by Professor Franz Poepel of the *Technische Hochschule* in Stuttgart, Germany, as translated in resumé by C. E. Keefer in the October 1950 issue of *Water & Sewage Works*. Lest the conclusions of that article gain partial acceptance in the United States, the following protest is presented.

Professor Poepel appears to have overlooked almost all of the theories of sedimentation, based on hydrodynamics and other phases of fluid mechanics, so carefully developed by Hazen, Rouse, Shields, Prandtl, von Karman, Camp, Nikuradse, Vanoni, et al. No consideration is given to flocculation or hindred settling as influenced by horizontal velocities or differential settling rates, to scour or bed-load movement, to density currents and other factors influencing short-circuiting, and to the conditions at the inlet and outlet zones.

Horizontal Movement Influence

On page 423 of the original article in Oct. 1950, it states, "Experience indicates that the horizontal movement of water in a settling tank exerts no influence worth mentioning on the settling of suspended material," despite the fact that the contrary has been established by the theories and experience of many competent authorities. Then Prof. Poepel contends that "Suspended solids are precipitated only in the laminary zone in settling tanks," having previously implied that the "laminary zone" refers to small particles subjected to viscous settling where Stokes' law is valid. This statement would exclude the sedimentation of gravel and large grit which certainly must settle under turbulent conditions. In our opinion, other inaccurate statements can be cited but will not be enumerated here.

In lieu of hydrodynamic theories, Poepel presents simple arithmetic formulations based on Stokes' law and the dimensions of cylindrical settling basins. Stokes' law is manipulated to give two basic formulae, (11) and (11a), for particules of specific gravity 1.1 and 1.2 respectively, at 20° C. Unfortunately, formula (11) is in error by almost 100 percent, and worse yet, this formula is the basis for most of the subsequent examples, the final recommended formulae, and the nomograph. In Table I, moreover, formulae (11) and (11a) are applied outside of the limits of Stokes' law, i.e. above a Reynolds' number of 0.5 and below a Reynolds' number of 10^{-4}.

Basis of Concepts

The fundamental concepts of the article are based on formula (18b) viz:

$$\frac{R}{h} = \frac{v}{s}$$

where R is the tank radius, h is the tank depth, v is the flowing-through velocity (the radius divided by the theoretical detention period) and s is the settling velocity. This formula is true insofar as it employs the flowing-through velocity which, at a point halfway between the center of the tank and the periphery, is equal to the so-called "average radial velocity."

At any other point on a radius, however, the instantaneous horizontal velocity is considerably different, so that a given particle does not settle in a straight line, which would be the vector sum of v and s, as shown in Fig. 1 in the original article and the accompanying sketch for an ideal rectangular basin. Instead, a particle settling in an ideal cylindrical tank follows a curvilinear path as shown in the sketch.

Finally, in his addenda, Poepel tries to correlate the results of sedimentation in rectangular and circular tanks, ending with the untenable conclusion that rectangular tanks will have the same efficiency as circular ones *only when the width of the rectangular tank is about three times the length!!!!* Since lengths are generally greater than widths, Poepel concludes, "This permits the theoretical conclusion, which has been confirmed by practical experience, that radial-flow circular tanks will have a greater clarification effect than rectangular tanks with the same surface area." Poepel's "experience," called upon in this article to justify his contentions, seems to be at variance with modern American results.

Summary of Theory and Practice

Lest this critical protest leave the reader in a quandary as to what to believe about circular and rectangular tanks, a very brief summary of the theory and practice of sedimentation is presented herewith.

1. Settling tanks should be designed primarily on the basis of the settling velocities of the particles to be removed, depending on the size and specific gravity of the particles. Depth and detention period are secondary considerations.

2. To minimize the effects of density currents, longitudinal mixing, and

turbulence at inlet and outlet zones, settling basins should be long, narrow, and shallow. Economics of construction, however, frequently dictate a practical limit to the length-width ratio. Rectangular tanks are generally indicated as being superior to circular tanks, especially for large installations.

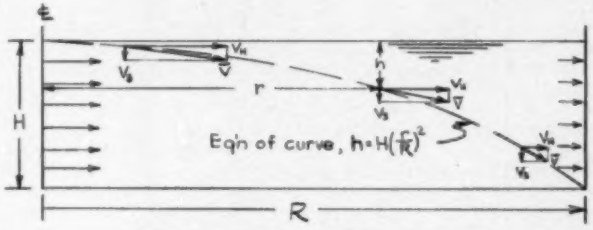
3. There is a practical limit to shallowness because excessive turbulence hinders settling, and high horizontal velocities produce scour and bed-load movement. Horizontal velocities up to 10 ft. per minute have been found to be acceptable. The depth of a basin must also be great enough to permit the installation and proper functioning of sludge-collecting mechanisms.

4. Low weir discharge rates are essential to prevent strong rising currents at the outlet zone. In that they provide a long periphery for a given surface area, circular tanks are superior in this respect to rectangular basins with simple end weirs. This disadvantage in rectangular tanks can be overcome, however, by the use of U-shaped or H-shaped weirs.

5. Many practical considerations give circular tanks a definite place in the design of water and sewage works. Circular tanks are indicated where

IDEAL RECTANGULAR TANK

small dimensions and the availability of standard scraping mechanisms make them more economical than rectangular tanks of the same surface area, *provided* that the maximum possible efficiency is not essential. For example, in a small complete sewage treatment plant, where sedimentation prior to biological treatment is required only to remove the coarse solids, circular primary tanks may be more economical. To the perfectionist, however, long, narrow, shallow rectangular tanks are superior.



IDEAL CYLINDRICAL TANK

OKLAHOMA SHORT COURSE SUCCESSFUL

According to Foster S. Burba, Instructer in Water and Sewage at Oklahoma A & M the Oklahoma Water, Sewage, and Industrial Waste Short Course at the end of November was quite successful. One hundred and fifty-four persons registered for the five day school which consisted of lectures, discussions, and laboratory work. This annual event is the back bone of the present voluntary certification program for operators sponsored by the O.W.S. & I.W.C.

Of the Wednesday evening session, Burba writes "The men sat down to laugh and relax as Mary Maude Moore, Master of Ceremonies opened the session. They were delighted by the musical accomplishments of the Aggie Sweethearts. At the conclusion of that portion of the program, the assembled 'students' leaned back to listen to 'another' speech—this one by FSIWA President Ralph E. Fuhrman. All present were pleasantly surprised, however, when he related 'What's New in Sewage Works' in layman's language and yet left food for thought for the top men present. This was evidenced by the informal discussions which followed his talk."

At the Conference Business session, an industrial wastes section was formed in the Oklahoma Water and Sewage Conference.

Successful Meeting Ingredients

(Left—An Aggie Sweetheart; 5 Aggie Sweethearts; Ralph E. Fuhrman, Pres. FSIWA, Washington, D.C.; R. B. Riddle, Conf. Vice Pres., Frederick, Okla.; Quinton B. Graves, Prof. Okla. A. & M.. J. K. Lindsey, Asst. San. Engr., Okla. Dept. of Health; Ray Lindsey, Partner, C. H. Guernsey & Co.; John Mullins, Supt. Sew. Treat., Bartlesville, Okla.)

A.W.W.A. Board Actions

A. E. Berry for President; C. H. Capen for Vice-President; W. W. Brush for Treas.; W. R. LaDue, Diven Medalist; M. S. McIlroy, Goodell Prize Winner; Honorary Membership to Chas. R. Cox, Sam. B. Morris, S. T. Powell.

President Elect
Albert E. Berry
Toronto

Vice-Pres. Elect
Chas. H. Capen
Wanaque, N.J.

THE Board of Directors of the Am. Water Works Assn. at its annual meeting in New York City, January 14-16, amongst the vast amount of business transacted, voted the awards named herein to members and Sections.

At this writing, already over the usual dead-line for an issue, it is not possible to high-light other important actions taken by the Board because time is not available before this issue goes to press to develop the customary report covering all important actions of the A.W.W.A. Board. In fact, the Board is still in session while this is being written and the report must be completed in our March issue.

Since this (February) issue has already been made up and awaits press run it is necessary to insert this report at the end of the main article section, where the editorials usually appear, in order to get it into this issue rather than to delay the announcement of awards and new officer nominations until our March issue.

Officers Chosen

Meeting as the Nominating Committee, the Directors, representing the several Sections, named the following as their choice for A.W.W.A. officers for the year 1951-1952. The official nominees are automatically declared elected if no contenders for the same offices are nominated by the membership at large before March 1, 1951. The terms of these 1951-1952 officers take effect at the close of the 1951 Convention at Miami, Fla., April 29-May 4.

For President

Albert E. Berry, Chief Engr., Ontario Dept. of Health, Toronto. (Sec.-Treas. of the Canadian Section)

For Vice-President

Charles H. Capen, Chief Engr. North. Jersey Water Supply Comm., Wanaque, N.J.
(Chrmn. A.W.W.A. Publication Committee)

For Treasurer

William W. Brush, Editor Water Works Eng., New York
(Nominated for his 25th Year as Treasurer.)

Honorary Memberships

Honorary membership was bestowed upon these distinguished members:

Medallist
W. R. La Due
Akron

S. B. Morris
Los Angeles

Honorary Members
S. T. Powell
Baltimore

C. R. Cox
Albany

Treasurer
W. W. Brush
New York

CHARLES RAYMOND COX, Chief, Water Supply Section, N. Y. State Dept. of Health, Albany, N. Y. A member of the Association since 1921. Fuller Awardee, 1940. Director, New York Section 1941-44; Chairman, New York Section 1940-41. Secy. Water Purification Div. 1935-47. A.W.W.A. representative on Advisory Committee to USPHS for Revision of "Drinking Water Standards"; cooperator in the revision of "Manual of Water Quality and Treatment."

"An effective servant of the people of New York, whose professional competence, teaching ability and writings has led to long range improvement in public water supply quality in his state and over the nation."

SAMUEL BROOKS MORRIS, General Manager and Chief Engr., Los Angeles Dept. of Water and Power. Previously Dean of Engineering, Stanford University. A member of the Association since 1920. Diven Medalist 1933. President of the Association 1944. Director from California Section, 1930-33; Secy.-Treas., California Sect. 1923-25; Vice-Chairman 1926; Chairman 1927. Member A.W.W.A. Committee on National Water Policy and the President's Commission on Water Resources Policy, 1950-1951.

"The chief executive of a great publicly owned water and electric utility whose engineering ability, business courage and genuine human qualities make him an honored leader of men."

SHEPPARD TAPPEN POWELL, Consulting Chemical Engineer, Baltimore, Md. A member of the Association since 1906. Fuller Awardee 1947. Chairman, Water Purification Div. 1935. Associated with the preparation of various editions of "Standard Methods," contributor to revised "Manual of Water Quality and Treatment." Organized the Joint Committee on Boiler Feedwater Research and served as its Chairman from 1925 to 1935. Member of Engrs. Joint Council's Special Committee on a National Water Policy, 1950.

"An international authority in the production and control of quality of boiler and process waters—whose writings and services have contributed greatly to the industrial potential of his country."

Awards

The *John M. Diven Medal* is awarded that member of the Association who has rendered an outstand-

ing service to the A.W.W.A. It was voted to—

WENDELL R. LA DUE
Supt. & Engr., Dept. Water & Sewage, Akron, O.

"For his conduct of the activities of the Committee on Water Works Administration; his service as General Chairman of the Committee since its organization in 1947; his selection of key men for subcommittee leadership; and his stimulation of committee work—all of which have brought credit to him and to the Association."

The *John M. Goodell Prize* is voted that member who has made the most notable contribution in the nature of a paper presented before the Association as printed in the A.W.W.A. Journal during the year. It was voted to—

MALCOLM S. McILLROY
Prof. of Electrical Engrg., Cornell Univ.

"For his paper entitled "Direct-Reading Electric Analyser for Pipeline Networks" which is to be found in the Journal of A.W.W.A. for April 1950—a lucid presentation of a difficult subject and work of a very high order productive of results of marked value to the profession."

Two additional papers were cited for their outstanding qualities and value to the profession. These were "Design Standards for Large Diameter Steel Pipe" by Walter H. Cates, Mgr. Hydraulic Div., Consolidated Western Steel Corp., Los Angeles; and "Experiences with High Rate Filtration of Water" by John R. Baylis, Engr. of Water Purification, Chicago, Ill.

The Cates paper is to be found in the A.W.W.A. Journal for Sept. 1950; the Baylis paper in the issue of July 1950.

Section Awards

The *Hill Cup Award*, to that Section which has made the greatest membership gain during 1950, was won by the Kansas Section, with the Florida and Indiana Sections as runners-up. The ratings were—

Kansas Section — 40.96
Florida Section — 34.82
Indiana Section — 33.48

(These ratings are computed on the basis of member gains as against potential membership within the area covered by the section.)

The *Henshaw Cup Award*, to the Section having the highest percent of its total membership in attendance at its annual meeting during 1950, was won by the Canadian Section, with the Rocky Mountain and Montana Sections the runners-up. The standings were—

Canadian Section	68.9%
Rocky Mts. Section	63.4%
Montana Section	62.1%

The *Old Oaken Bucket Trophy* was as usual to remain in the possession of the California Section, which continues to hold almost a 300 member lead over the next largest section—the New York Section. Ratings at year end of the three largest Sections were—

California Section — 916
New York Section — 666
Southwest Section — 617

(It is to be noted that the fast moving Southwest Section has now nosed out the Canadian Section from second position, and is now pulling up rapidly to the New York Section. Some are even predicting that California's "Old Oaken Bucket Trophy" is getting in reaching distance of the "Souwesters".)

Canadian Section Now Has Maritime Branch

In line with authorization of the A.W.W.A. Board of Directors the Canadian Section has established its first Branch in the Maritime Provinces. It is to be known as the Maritime Branch of the Canadian Section.

At its third annual meeting held in St. John, New Brunswick, the Maritime Water Works Association unanimously voted to join the Canadian Section as its first Branch. The meeting had an attendance of 150 and represents an imposing Branch—larger than many of A.W.W.A. State Sections.

The Maritime group was organized by Ira P. Macnab, Manager, Halifax Water Utility, who served as its president. J. D. Kline, Chief Engr., Halifax Public Service Comm., has been serving as Secy.-Treas. of the Maritime Water Works Assn.

Officers elected to guide the new Branch are:

President
W. R. Godfrey, Director of Works, St. John Water & Sewerage Dept.

Vice Presidents
F. C. Wightman, Cons. Engr. Amherst, N.S.

N. B. Eagle, Supt. of Water Moncton, N.B.

S. C. Matheson, Supt. Water & Sewerage Charlottetown, P.E.I.

R. F. Martin, Asst. City Engr. St. Johns, N.F.

S. T. E. Fetterly, Mfgrs. Rep. Waterville, N.S.

J. L. McAvitty, Mfgrs. Rep. St. John, N.B.

Secy.-Treas.
J. D. Kline, Chief Engr. Halifax Public Service Comm.

The Maritime Branch will serve all four of Canada's Maritime Provinces, each of which will be represented by one vice-president, as listed herein. Ira P. Macnab, organizer of the Maritime Association, was acclaimed first past-president of the Maritime Branch.

Dr. A. E. Berry in his dual capacity as Vice-President of A.W.W.A. and long-time Secretary of the stalwart Canadian Section was on hand to proudfully receive the first and only "grandson of A.W.W.A." which came into being as a lusty and vigorous infant.

Congratulations, Canadian Section; and all hail to you Maritime Branch.

"Well, you see we have a lot of floods hereabouts."

Sewage Treatment—Design and Specification

The Contractors Record Ltd., London, Eng., has published a book entitled "SEWAGE TREATMENT—DESIGN AND SPECIFICATION," by L. B. Escritt. This book has assembled as much practical information on the design and specification of works for sewage treatment as the space permits, in order to give the most assistance to the man actually engaged on engineering design, without involving lengthy reading. It covers chemistry, strength and rate of flow of sewage; measurement of flow; layout of works; preliminary treatment; separation and treatment of storm water; sedimentation; land treatment; percolating filter treatment; activated sludge treatment; specification writing and many other phases of the subject.

The book consisting of over 257 pages, contains 122 photographs and illustrations, 39 tables, 20 formulas and is available from the Contractors Record, London, England, for thirty shillings per copy.

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Analysis of grit removed by this system shows less than 10% volatile matter and only a negligible trace of putrescible organics. Because coarse sewage material will not interfere with the operation of the Aer-Degritter and because it does not affect the hydraulic design of the plant, Aer-Degritters may be installed ahead of all mechanical equipment.

'Chicago' Aer-Degritters have been operating successfully at Oildale, California; Columbus, Ohio; Tomah, Wisconsin; and Bellaire, Texas. Additional Aer-Degritters are being installed in Sedalia, Missouri; Ann Arbor, Michigan; Jasper, Indiana; and Fort St. John, B. C., Canada.

F.S.W.A. Convention

Washington, D. C.

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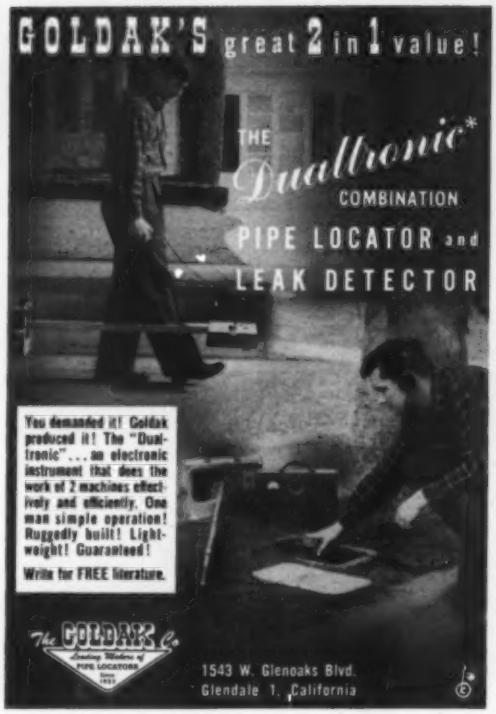
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MEETINGS SCHEDULED:

FEB. 7-9—INDIANAPOLIS, IND. (Lincoln Hotel)
Indiana Section A.W.W.A. Sec'y, G. C. Fassnacht, State Board of Health, 1098 W. Michigan St., Indianapolis 7, Ind.

FEB. 14—NEWARK, N. J. (Hotel Essex House)
New Jersey Section A.W.W.A. (Winter Luncheon Meeting) Sec'y, C. B. Tygert, P. O. Box 178, Newark, N. J.

FEB. 15—BOSTON, MASS. (Statler Hotel)
New England Water Works Association. Sec'y, Jos. C. Knox, 73 Tremont Street, Boston 8, Mass.

FEB. 15-16—ANN ARBOR, MICH. (Univ. of Michigan, School of Public Health)
Water Works Problems. The 3rd Inservice Training Course given in cooperation with the Michigan Section A.W.W.A. Dir., H. E. Miller, School of Public Health, Univ., of Michigan, Ann Arbor, Mich. (Enrollment Fee—$5.00)

FEB. 19-22—NEW YORK, N.Y. (Waldorf-Astoria Hotel)
National Council for Stream Improvement. Sec'y, Russell L. Winget, 271 Madison Ave., New York 16, N. Y.

FEB. 21-23—W. LAFAYETTE, IND. (Purdue Univ. Memorial Union)
6th Purdue Industrial Waste Conference. Chairman, Don. E. Bloodgood, Prof. San. Eng., Purdue Uni., W. Lafayette, Ind.

MAR. 5-8—PUEBLO, COLO. (Hotels Congress, Vail, Whitmore)
Rocky Mountain Annual School for Water and Sewage Plant Superintendents. Sec'y, Geo. J. Turre, P. O. Box 600, Denver, Colo.

MAR. 11-15—COLLEGE STATION, TEXAS (Texas A. & M.)
Texas Water & Sewage Works Association. Sec'y, V. M. Ehlers, 501 West 33rd St., Austin 2, Texas.

MAR. 13-16—NEW YORK CITY, N.Y. (Hotel Statler)
National Association of Corrosion Engineers. Exec.-Sec'y, A. B. Campbell, 919 Milam Bldg., Houston, Texas.

MAR. 14-16—ATLANTIC CITY, N.J. (Hotel Haddon Hall)
New Jersey Sewage & Industrial Waste Assn. Sec'y, Michael S. Kachorsky, Box 283, Manville, N. J.

MAR. 15—BOSTON, MASS. (Statler Hotel)
New England Section A.W.W.A. Sec'y, George G. Bogren, Weston & Sampson, 14 Beacon Street, Boston 8, Mass.

MAR. 28-30—GRAND CANYON, ARIZ. (El Tovar Hotel)
Arizona Sewage and Sewage Works Association. Sec'y, Mrs. Helen Rotthaus, Capitol Bldg., Phoenix, Ariz.

MAR. 28-30—BATON ROUGE, LA. (Louisiana State Univ.)
Louisiana Conference on Water Supply & Sewerage. Sec'y, Dan L. Winters, c/o Gulf Public Service Co., Inc., New Iberia, La.

MAR. 28-30—CHICAGO, ILL. (LaSalle Hotel)
Illinois Section A.W.W.A. Sec'y, J. L. Hart, U.S. Pipe & Foundry Co., 122 So. Michigan Ave., Chicago 3, Ill.

APR. 5-6—OLD POINT COMFORT, VA. (Hotel Chamberlain)
Virginia Industrial Wastes & Sewage Works Assn. Sec'y, A. H. Paessler, 815 E. Franklin Street, Richmond 19, Va.

APR. 5-6—ALBANY, N.Y. (Hotel Ten Eyck)
New York Section A.W.W.A. (Spring Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York 20, N. Y.

APR. 9-11—HOT SPRINGS, ARK.
Arkansas Water & Sewage Conference. Sec'y, Harrison Hale University of Arkansas, 118 Chemistry Bldg., Fayetteville, Ark.

APR. 11-13—HAYS, KANSAS (Lamar Hotel)
Kansas Section A.W.W.A. Sec'y, H. W. Badley, 640 Highland St., Salina, Kans.
Kansas Sewage Works Association. Sec'y, Dwight F. Metzler, State Board of Health, Univ. of Kansas, Lawrence, Kans.

APR. 19-20—LINCOLN, NEB. (Cornhusker Hotel)
Nebraska Section A.W.W.A. Sec'y, E. Bruce Meier, 201 Mechanic Arts Bldg., Univ., of Nebraska, Lincoln, Neb.

APR. 19—HELENA, MONT. (Hotel Placer)
Montana Sewage Works Association. Sec'y, H. B. Foote, State Board of Health, Helena, Mont.

APR. 20-21—
Montana Section A.W.W.A. Sec'y, Arthur W. Clarkson, State Board of Health, 1036—8th Ave., Helena, Mont.

APR. 25-28—FRESNO, CALIF. (Hotel California)
California Sewage Works Association. Sec'y, Lawrence H. Cook, Box 696 Menlo Park, Calif.

APR. 29-MAY 4—MIAMI, FLA.
American Water Works Association. (Annual Convention.) Exec.-Sec'y, Harry E. Jordan, 500 Fifth Avenue, New York 19, N. Y.
(Meetings and Exhibits in the Dinner Key Auditorium. All hotel reservations will be cleared through the A.W.W.A. office.)

MAY 15-16—VANCOUVER, B.C., CANADA (Hotel Vancouver)
Pacific Northwest Sewage Works Association. Sec'y, Wm. P. Hughes, City Hall, Lewiston, Idaho.

MAY 17-19—
Pacific Northwest Section A.W.W.A. Sec'y, O. P. Newman, Boise Water Department, Boise, Idaho.

MAY 21-23—WINNIPEG, MAN., CAN. (Alexandria Hotel)
Canadian Section A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Department of Health, Parliament Building, Toronto, Ont.

JUNE 4-6—GRAND RAPIDS, MICH. (Hotel Pantlind)
Michigan Sewage & Industrial Wastes Assn. Sec'y, Donald M. Pierce, State Dept. of Health, Room 334 Administration Bldg., Lansing 4, Mich.

JUNE 7-8—SPRINGFIELD, MASS. (Hotel Kimball)
New England Sewage & Industrial Waste Assn. Sec'y. Walter E. Merrill, State Dept. of Health, 511A State House, Boston, Mass.
(Joint Meeting)
New York Sewage & Industrial Wastes Assn. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N. Y.

JUNE 20-22—COLUMBUS, OHIO (Neil House)
Ohio Sewage and Industrial Wastes Treatment Conference. Sec'y, J. E. Richards, 302 Departments Bldg., Columbus 15, Ohio.

AUG. 20-22—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y, R. Rupert Kountz, Penna. State College, State College, Pa.

AUG. 22-24—
Pennsylvania Sewage & Industrial Wastes Association. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 17-19—LOUISVILLE, KY. (Kentucky Hotel)
Kentucky-Tennessee Section A.W.W.A. Kentucky-Tennessee Industrial Wastes & Sewage Works Assn. Sec'y, R. P. Farrell, 420 Sixth Ave., N., Nashville 3, Tenn.

SEPT. 19-21—ST. JOSEPH, MICH. (Whitcomb Hotel)
Michigan Section A.W.W.A. Sec'y, T. L. Vander Velde, 2609 E. Saginaw Street, Lansing 12, Michigan.

SEPT. 24-26—BELOXI, MISS.
Alabama-Mississippi Section A.W.W.A. Sec'y, Chas. W. White, 519 Dexter Ave., Montgomery, Ala.

SEPT. 25-27—MILWAUKEE, WIS. (Hotel Pfister)
Wisconsin Section A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

SEPT. 27-28—TOLEDO, OHIO
Ohio Section A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

SEPT. 30-OCT. 2—ST. JOSEPH, MO. (Robidoux Hotel)
Missouri Section A.W.W.A. Missouri Water & Sewage Conference. Sec'y, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

OCT. 8-11—ST. PAUL, MINN. (Municipal Auditorium)
Federation of Sewage & Industrial Wastes Assns. (Annual Convention) W. H. Wisely, 325 Illinois Building, Champaign, Ill.

OCT. 14-17—FORT WORTH, TEXAS (Hotel Texas)
Southwest Section A.W.W.A. Sec'y, L. A. Jackson, Memorial Auditorium, Little Rock, Ark.

OCT. 23-26—ATLANTIC CITY, N.J. (Hotel Claridge)
Pennsylvania Water Works Association. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

OCT. 23-26—SAN FRANCISCO, CALIF. (Fairmont Hotel)
California Section A.W.W.A. Sec'y, Wm. W. Aultman, Box 38, LaVerne, Calif.

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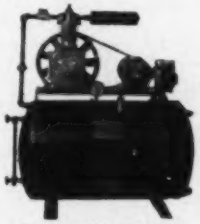

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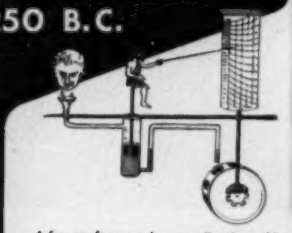

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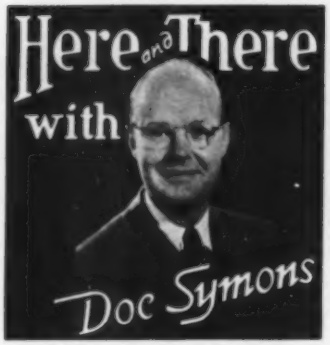

Here's That Man Again—And, while you won't be reading this until some time in February, I'm writing it on New Year's Eve—a time when I, among millions of others, usually shout, "Happy New Year, and may it bring every good thing to you!"—

But this time, I, and probably millions more, am in a sober mood (no play on words intended). This year it seems more appropriate to read this "Prayer for Peace" which I cut out of a newspaper from Ottawa, Canada.

A PRAYER FOR PEACE

Give us the will and the patience
to look back far enough . . . .
to travel again in our minds
the various roads mankind has travelled
so that we may know
his fears, his problems, his gods,
and understand his behavior

Let honesty and wisdom dictate
our decisions,
let courage carry them out.

Make us worthy of peace in our time.

HELEN BALL

Toronto

Of course, you recognize the author, Helen Ball, the wife of O. V. (Ollie) Ball, engineer staff member of Dr. A. E. Berry's organization in the Ministry of Health in Toronto.—You've seen some of her stuff here before, in the lighter vein—It's always good.

* * *

Welcome to the fold!—Among the newcomers to those of us who spend much of our time travelling to and attending conventions of various organizations in this field of endeavor is RAY FAUST, formerly Chief of the Water Bureau of the Div. of Engng., of the Michigan State Board of Health. John Hepler's loss will be the gain not only of the AWWA for which Ray will be Exec. Asst. Secy. but also the gain of all members of that oldest of water works organizations.

Welcome also to JOHN STEWART, who is the new Manager of the Water and Sewage Works Manufacturers Assn. You'll be seeing him at all the big conventions doing his stuff. I first met John when I had arranged for the annual meetings of the New York Sew. and Ind. Waste Assn. in New York City each January. Boy—! If Stewart produces for the WSWMA the way he produced for me at the Statler Hotel here, then I predict a rosy future for the Manufacturer's organization.—He'll have the help of "Dottie" Dimmers as Secretary of the Assn.—Of Course!

* * *

At the Bridgeport meeting of the NESWA last September, Johnny McDonald, Supt. of Sewage Treatment at Springfield, Mass., gave me this picture.

Here you see a buffet supper being held on the last Thursday in August

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CEMENT MORTAR LININGS FOR WATER MAINS

Centrifugally Applied in Strict Conformity with A. W. W. A. Specifications

in the sludge incinerator building of the Springfield Sewage Treatment Plant. The picture was taken only about a *half hour* after the incinerator plant was shut down. There were about 32 employees present to honor Thomas Rourke who was retiring at the age of 65.

What good housekeepers McDonald's men must be—and wasn't it a good bit of public relations.

* * *

Cleaning up my desk for the new year I ran across a few more pictures taken at the Annual Meeting of the NEWWA held at Poland Spring, Me., last September.—There's nothing like silly hats to liven a party and here's the proof—

The girl is Linda (Mrs. Robt. T) Browning — Her husband, Bob Browning is an important guy in Electro-Rustproofing of Newark and she, if you remember the item from a couple of years ago was the heroine of Small World No. 9. In which I told how Linda was probably the first girl in my life, at the age of three having been the daughter of the local grocer in Riverton, Ill., where I spent the years of two to six.—But to get back to the picture again. The man in the middle is Truman Safford, Cons. Engr. of Charles T. Main, Co., Boston.—And the man on the right who is looking somewhat disdainfully down on these merrymakers, while he, himself, wears a benny with a feather, is none other than Phil Holton, Jr., Chief Engineer of the Providence, R.I. Water Supply Comm.

* * *

H. G. Baity, Prof. of San. Engr. at the Univ. of North Carolina (Chapel Hill) is now in Europe doing some work for the World Health Organization. In his absence, Jack J. Hinman, Jr. of Iowa is acting as Visiting Professor and Jack recently wrote as follows:

"Prof. Harold Babbitt of the Univ. of Illinois was here the other day and he was much amused by a sign on the room which Professor Baity has been using as an office during the period of construction of the New Medical School Building. In nice gilt letters, the sign on the door reads: LARGE

Specify SARAN LINED steel pipe

CORROSION PREVENTION IS MORE PROFITABLE THAN EQUIPMENT REPLACEMENT!

WHAT part of industry's six billion dollar corrosion bill are you paying? Any amount is too much and can be cut considerably through the installation of saran lined steel pipe. You will find, as have many of the country's leading manufacturers, that saran lined steel pipe means dependable, long term operation. In addition to the excellent corrosion resistance of this remarkable pipe—you have the plus values of rigidity, pressure strength and ease of installation, requiring NO special tools. These advantages are all important to you in the reduction of shut-down time, lost production and equipment replacement.

Send in the convenient coupon to The Saran Lined Pipe Company, Dept. MTSP-509, for more detailed information on saran lined pipe.

★send today!

Please send me a copy of your catalog on Saran Lined Pipe, Valves and Fittings.

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product

ANIMAL ROOM. — I occupy the room now!"

***—*No* Comment, Jack!

* * *

I'll bet the WSWMA wishes all persons who attended conventions were like Jimmy Brown, Jr., of Emerson, N.J. (his Dad is Sanitary Engineer of the Lederle Labs at Pearl River, N.Y.). Anyway—Down at Washington at the FSIWA meeting last October, young Jimmy wasn't interested in the speeches, he wanted to see the exhibits. Couldn't tear himself away, even with parental coaxing, cajoling, or demanding.—Jimmy, Jr. knows a good thing when he sees it. —There were some mighty good exhibits at that meeting.

* * *

Trust Homer Wisely to come up with another witticism at the annual Federation Board Meeting — This time while talking about the Journal of which he is Editor, he said, "The flow of sewage material is continuing."—And if any of you dropped a folded dollar bill at the Statler Hotel Cashier window, Homer has it.

* * *

Here's another reason why I am sorry I didn't get up to the Canadian Sewage meeting at Bigwin Inn last September. "Jim" Daly, Man. Editor, *Engineering and Contract Record* of Toronto supplies this picture of William Storrie, disguised as an umpire

for the ball game. Jim says, Mr. Storrie was about to throw out the first ball, shouting the Scottish equivalent of "Play Ball"—I hear that Mr. Storrie suffered a heart attack after the CISS convention but is up and around again.

* * *

Society of Council Bluffers!!!—The accompanying greeting came addressed to your current president, from fellow member W. R. LaDue. I'm sure you will appreciate the sentiment.

TO ALL
COUNCIL BLUFFERS

SOK SZERENCSÉT KIVANOK
AZ UJESZTENDOBEN
Akron város magyar családjainak'

W. R. LA DUE
A városi vizmüvek igazgatója és főmérnöke

* * *

With the passing of "Charlie" Hoover, I lost one of my favorite persons (even before he became a fan of this column a number of years ago). Somehow, I don't think I ever quite got around to telling Charlie Hoover just how much a great many of us thought of him.—You and I know that there are too many persons who receive their plaudits after death, and it's high time we got around to passing out bouquets while they are still with us to appreciate our sentiments.

For that reason, I should like to inaugurate in this column a regular feature extolling the merits of some one you, the readers, would like to applaud. Will you therefore start contributing your nominations and a few well chosen words as to why you think so-and-so should be singled out for "Hat's Off To." A picture would

IN CHLORINATION...

...the SIMPLE Way is the BEST Way!

Here's chlorination that's extra easy. Plants that use Builders Visible Flow Chlorinizers profit in many ways by their unique simplicity. These chlorine gas feeders are easy to understand, easy to operate, easy to service. Chlorination — whether manual, semi-automatic, program, or flow-proportional — is a safe, dependable operation when it's handled by Builders Chlorinizers. They are easily serviced by any competent mechanic and individual parts and sub-assemblies are easily replaceable. For complete information and Bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, R. I.

BUILDERS PRODUCTS

The Venturi Meter • Propeloflo and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyoflo Meters • Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Chlorinizers — Chlorine Gas Feeders • Filter Operating Tables • Pneumatic Meters • Chronoflo Telemeters

Installation at R. I. State Sanitarium, Wallum Lake, R. I.

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help. I haven't fully decided just what to call the feature yet so I shall appreciate ideas, but I think you understand what I want to do.

A lot of men I know have had honors by the dozens heaped upon them for their services to the water and sewage works industry, but there are dozens of others who have worked behind the scenes, or have been hugely successful in their own city, or are just "wonderful" guys. I'd like to "Give a little applause to" one each month. Will you help?

* * *

Gosh, here it is, the end of another column, and I still haven't told you those other stories about the Federation meeting, or showed you the pictures of some prominent members of the Wisconsin AWWA Beaine Club, but come next month we'll try to get it all in, along with some interesting letters.

V.T.Y.—Doc

The Spillway

(Overflow From The Main Section)

IJC Completes Boundary Water Study and Report

The International Joint Commission on Boundary Waters has completed its four year study of the waters between Canada and the U.S. in the Lake Superior-Lake Huron; Lake Huron-Lake Erie and Lake Erie-Lake Ontario areas. The report outlined the extent of the pollution and called for an end to it by enforcement of an international clean-up. The commission presented certain objectives which it urged be adopted into law by the two nations.

The total cost of the clean-up was estimated at $125,000,000 for the three areas; i.e., the St. Mary's River, the Detroit-Windsor area, and the Niagara River. The worst pollution is in the Detroit-Windsor area and affects 3,487,000 persons.

No estimate was made of how long it would take to construct all remedial measures, but the report urged immediate primary treatment and disinfection of all municipal wastes.

The total discharge of municipal wastes was found to be 750 mgd. of which 20 per cent is untreated and the remainder only partially treated. Industrial wastes total 2 billion gal-

From Break to Service *in 11 minutes...*

THE KENNEDY SAFETOP is the only hydrant with the threaded breaking ring that gives positive connection and rigid alignment of the two standpipe sections. Extensive tests and actual service reports show that the Kennedy *Safetop* can stand as tough a blow as the conventional hydrant without damage. But under a smashing impact, it always breaks cleanly at the breaking ring, without damage to working parts.

SHEARED OFF by a heavy road-scraper at 1:26, the Kennedy Safetop breaks evenly at the ground level.

Photos taken at N. Y. State Section meeting, A.W.W.A., April 1949.

WITH ONLY an inexpensive *Safetop* Repair Kit and a few common tools, one man can permanently repair the Kennedy *Safetop*.

NO NEED FOR DIGGING because breakage is all above ground . . . no flooding because compression-type valve closes with water pressure.

IN JUST 11 MINUTES the Kennedy *Safetop* is back in service . . . working as smoothly and efficiently as if nothing had happened.

THE COMPLETE KENNEDY LINE includes a wide range of A.W.W.A. valves and fire hydrants. When you standardize your community on KENNEDY, you are assured of the same high quality and dependability that have characterized all products of KENNEDY for 74 years.

WRITE FOR SAFETOP BULLETIN 105

Est. 1877

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lons a day and include 15,000 lb. per day of phenol, 8,000 lb. of cyanides, and 70,000 lb. of ammonium compounds. Ships discharge wastes equivalent to 3,900 persons per day.

Sewer Rental Started for New York City Jan. 1

As a part of the program of New York City to remove pollution from its surrounding waters the city instituted sewer rental last July to bring in an estimated $15,000,000 annually to help defray the cost of operating the sewage treatment works. The collection of sewer rents began Jan. 1, this year.

Basis of the sewer rental charge is a formula which sets the sewer rent at one-third of the annual water fee, whether this is computed by meter, as is the case of nearly all industrial and commercial users, or by flat rate or frontage rates which apply to most domestic consumers. Provision is made for cases where water is obtained from other sources in which case the charge is one-third of what the annual water rate would be if the water were obtained from the city. In case an industry does not return all of the water it buys or supplies to itself to the sewers, then the charge is based on the amount of water which actually enters the sewer.

This sewer rental will be applied to 751,254 water customers, and the funds collected will be used not only to operate and maintain existing sewers and treatment works but also to help defray part of the expense of financing the city's program for the construction of treatment works.

By the end of 1953, the city is scheduled to have spent $100,000,000 for treatment works as its first phase in its pollution abatement program. When the first phase is finished, the class "A" or principal bathing waters adjacent to New York are expected to reach a satisfactory degree of purity.

National Tech. Task Comm. on Ind. Waste Holds Second Meeting

The National Technical Task Committee, organized last May 22, held its second meeting at the end of November in Cincinnati. The committee represents 22 major industrial groups of the country in addition to State and Federal public health interests. Chairman is Lyman Cox, Supervisor, Engineering Service Division, E. I. duPont de Nemours and Co., Wilmington, Del.; Vice Chair. is Dr. Harry Gehm, Technical Advisor, National Council on Stream Improvement of the Pulp, Paper, and Paperboard Industry, New York City; and Secretary of the Committee is Louis F. Warrick, Chief, Technical Services Branch, Division of Water Pollution Control, Public Health Service, Washington, D.C.

Included in the program of the meeting was a detailed inspection of the work of the Environmental Health Center of the USPHS in Cincinnati, with particular reference to its industrial waste work. The work of the Center was described by Vernon G. MacKenzie, Officer in Charge.

Carl Swob, Chief of the Water Pollution Control Division, Pub. Health Service, reported on progress of studies made in cooperation with the States under the Water Pollution Control Act of 1948.

Task groups which reported to the committee meeting were: Food Industries, by Frank McKee, Kraft Foods Co., Chicago; Mineral Products, by C. C. Burroughs, Shell Oil Co., New York City; and Chemical Processing, by Dr. Harry Gehm, New York City.

FOR TREATMENT OF SEWAGE and INDUSTRIAL WASTES

Specify SOLVAY

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LIQUID CHLORINE
SODA ASH
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SOLVAY Technical Service is available to assist you with any problems involving the treatment of sewage and industrial wastes. Also available on request are the following Solvay Technical and Engineering Bulletins. Write for your copies today.

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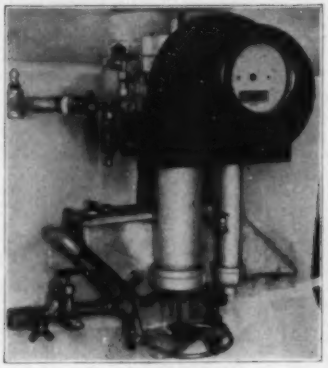
Manufacturers' and Equipment News



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Flow Meter Aid

Simplex Valve & Meter Co., Philadelphia, Pa., has announced the development of a flow meter aid consisting of a tilting tube device which can be used in lieu of the standard mercury cylinders which are ordinarily furnished on metering devices operated from differential head producing units. This device will eliminate the difficulty of primary devices such as Venturi tubes, flow nozzles and orifice plates having to be made larger or smaller than what could be called standard dimensions in order to accommodate desired results of flow by metering instruments having a standard differential.

The tilting tube is a form of U tube manometer wherein there is provided a means of moving the meter float a standard distance in response to various differential pressures. This is done by adjusting the tilting tube to any desired angle within its permissible movement, which change can be made in the field without recourse to substitution of different legs of other forms of mercury containers.

Tate Process Now Offered by Am. Pipe and Centriline

A cement-mortar lining service for old, small diameter pipe lines, that gives new pipe line performance at a fraction of new pipe line costs, is announced by Pipe Linings, Inc., newly formed subsidiary of American Pipe

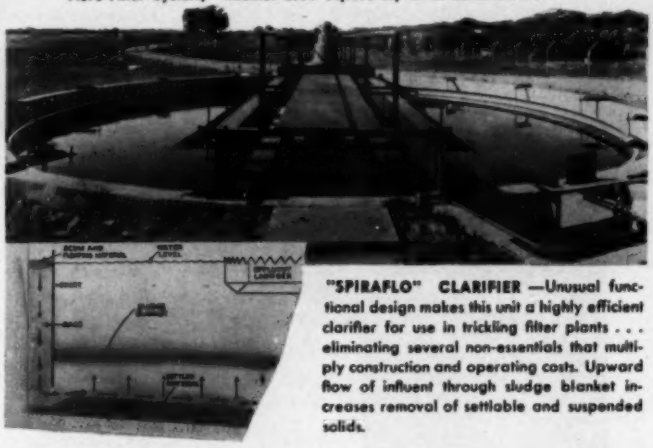
Establishing remarkable records for high purification at low cost—

YEOMANS "SPIRAFLO" CLARIFIER and "AERO-FILTER"

SINGLY . . . OR IN COMBINATION

. . . especially in the treatment of strong industrial wastes

Low construction cost . . . low operating cost . . . high purifying efficiency: these are the characteristics of the Yeomans "Spiraflo" Clarifier and the "Aero-Filter System," whether used separately or in combination.



"SPIRAFLO" CLARIFIER—Unusual functional design makes this unit a highly efficient clarifier for use in trickling filter plants . . . eliminating several non-essentials that multiply construction and operating costs. Upward flow of influent through sludge blanket increases removal of settlable and suspended solids.

"AERO-FILTER SYSTEM"—Simplified design of this high capacity biological trickling filter cuts construction costs—reduces size of required filter bed by about 85%. High efficiency of single stage operation eliminates need of installing and operating expensive conventional recirculating equipment.

FIT ANY REQUIREMENTS—Overall plant efficiency is always higher when the two units are used in combination; however, plants using either type of equipment or the combination can be designed to fit any needs for treating domestic and industrial wastes.

IMPORTANT INFORMATION—Facts as to remarkable records established by Yeomans units will be helpful in your project planning. Bulletins containing performance data, field engineering data and construction cost estimates are available on request—use the coupon.

YEOMANS

YEOMANS BROTHERS COMPANY
1423 North Dayton Street
Chicago 22, Illinois

Please send these bulletins:
☐ No. 6570—"Aero-Filter"
☐ No. 6790 "Spiraflo" Clarifier

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Company _____
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and Construction Co., P. O. Box 3428, Terminal Annex, Los Angeles, Calif. Licensed for nation-wide operations under Tate pipe lining patents, the new company has complete facilities for servicing water, gas and oil pipe lines of 4" diameter and larger.

The work is carried out on pipe lines in place. If there be any of our readers who are not already familiar with the Tate cleaning and lining process, we will say that specialized patented equipment is run through to first clean corroded matter and tubercles from the inside pipe walls, and then applies a smooth cement-mortar lining to the walls. As a result, red water and leaks are eliminated, flow coefficients are restored. In many instances pumping costs are reduced.

Small diameter pipes have been lined for many years by Tate Pipe Linings, Inc., of Andover, Mass., but this company is in the process of dissolution, and Pipe Linings, Inc. has acquired most of its equipment and key personnel for use by the new company.

Heretofore large diameter pipes in the West have been lined by the Centriline Division of the American Pipe and Construction Co. and in the East by the Centriline Corporation of New York City. The last named company is now licensed to also offer the Tate process of lining small diameter mains and distribution pipe in place.

Free descriptive booklet and complete information are available upon request addressed to American Pipe and Construction Co. of Los Angeles or Centriline Corp., 140 Cedar St., New York City, or to this magazine.

CHLORINE DIOXIDE TREATMENT

A PAINLESS CURE for a Sick Water Works

For use in by-pass around partially closed gate valve acting as a variable orifice to maintain a disinfecting residual while main is in use.

Discovery of contamination in the mains was mighty disturbing to a certain New England town of 15,000 people, extremely proud of its pure water supply. But the cure was simple and sure — %Proportioneers% Chlorine Dioxide System in ten days entirely eliminated the contamination while the mains were in use. In addition, the chlorine dioxide "saved face" for the water works since the treatment was completed virtually unbeknown to the water users.

TREATMENT: %Proportioneers% hydraulically operated Chem-O-Feeder, complete with Chlorine Dioxide Generator, was easily installed as shown in the diagram. No electricity or other outside power was required. A residual of 1 ppm as measured with O. T. was established in the mains and gave an actual residual of 2.5 ppm Cl and ClO_2 — without noticeable taste or odor. After 10 days, tests proved the sterilization complete, and the treatment was discontinued.

TODAY, in peace or war, pure water is a "must"! Every water works needs this emergency sterilization equipment. %Proportioneers% Chlorine Dioxide System is the ideal unit . . . it's complete, ready for instant use: to sterilize new mains, to eliminate contamination, to meet the emergencies of war. Investigate now, while equipment is still available. Write for bulletins.

%Proportioneers, Inc.% 350 Harris Ave., Providence 1, Rhode Island.

% PROPORTIONEERS, INC. %

202

Portable Residual Recorder

Wallace & Tiernan has developed a new portable chlorine Residual Recorder. An adaptation of the standard pedestal mounted recorder, it is constructed so that it can readily be disassembled and moved. This feature makes it useful for chlorine residual surveys in water distribution systems and for checking operations at various points within a water treatment plant.

New Officers For Worthington-Gamon

Worthington Pump and Machinery Corp., through its President Hobart C. Ramsey, announced the election of the following new officers of its subsidiary, Worthington-Gamon Meter Co., Newark, N.J.; Charles E. Wilson, (formerly president) Chairman of the Board of Directors; Robert R. Anderson, President; William C. Flanders, Vice President in Charge of Sales; and Walter H. Zeis, Secretary-Treasurer.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

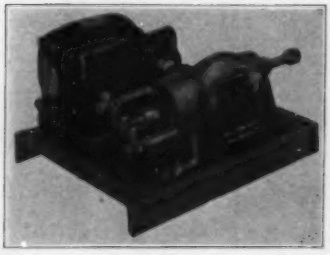
C. E. Wilson — R. R. Anderson
W. H. Zeis — W. C. Flanders

Mr. Wilson has served as President of Worthington-Gamon since 1946. In addition to his duties as Chairman of the Board of the subsidiary, Mr. Wilson continues as a Vice President of the parent company where he directs the sales activities of the Vertical Turbine Pump and Construction Equipment Divisions.

Robert R. Anderson, newly-elected President, joined the organization in 1922. In 1932 he was elected Treasurer, and in 1942 Vice President.

William C. Flanders joined Gamon Meter Company in 1925 as sales representative in New Jersey and was appointed Sales Manager of the Worthington-Gamon Meter Company in 1937.

Walter H. Zeis started his career with Worthington in 1925 and served in various accounting capacities until his election as Treasurer of the Subsidiary company in 1948.



203

Controlled Volume Pump

Milton Roy Co., Philadelphia, Pa., has announced the development of "miniPump" which is designed to meet the need for a controlled volume

SHOPPING FOR BLOWERS?

Look at *R-C dual-ability* with its wide selection to suit almost any job

Asking Roots-Connersville about blowers, exhausters and gas pumps has been standard practice among buyers for almost a century. That's because building such equipment is the only job we do. We're outstanding specialists in handling gas and air.

You'll gain from our wide varieties of sizes, types and capacities from 5 cfm to 100,000 cfm. We're the only manufacturers offering you the *dual-choice* between Centrifugal and Rotary Positive designs—and that *dual-ability* is important when it comes to matching the units to the jobs to be done.

So—when shopping, be sure to call on Roots-Connersville, the specialists. When you're interested in vacuum pumps, meters or inert gas generators, we're equally well fitted to fill these needs, too.

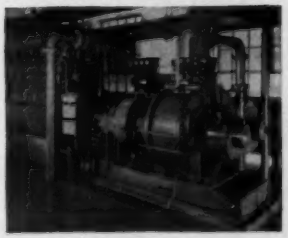
ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Mount Avenue, Connersville, Indiana

CENTRIFUGAL

Installation of 2-stage Centrifugal Blower in southern sewage treatment plant. Capacity 13,500 cfm.

One of two Rotary Positive Blowers, engine driven, in small sewage treatment plant. Capacity of each, 4,750 cfm.

ROTARY



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pump that will handle liquids in the ml. per hour range with precise metered accuracy.

The "miniPump" is a positive displacement type metering pump having a reciprocating plunger of ⅛ inch diameter. A cam, driven by a fractional gear-head motor, actuates the spring loaded cam follower attached to the plunger. Limiting the travel of the plunger by means of a simple graduated screw adjustment decreases the displacement, thus decreasing the volume delivered. All bearings are oil impregnated and self-lubricating.

The capacity can be varied with exactness anywhere from as low as 3 ml. per hour at minimum stroke length to 800 ml. per hour at full stroke length. Operating pressures are up to 1,000 psi.

Roberts' Quarter Century Club Adds Two Members

Roberts Filter Mfg. Co., Darby, Pa., held their third annual "Quarter Century Club" banquet and meeting on November 15th, 1950 for employees of the company who have served twenty-five or more years in the office, shop and field. Mr. Charles V. Roberts, President of the company, advanced from an honorary to a service member along with Mr. George L. Gaul, bringing the club membership to twenty service and three honorary members.

Mr. Clarence R. Jones was elected President and Mr. Percy Foster, Jr., re-elected Secretary of the club for the coming year.

Link-Belt Opens Factory Branch Store

Link-Belt Co., Chicago, Ill., announced that it has constructed and is now operating a new Factory

Branch Store located at 5020 Centre Ave., Pittsburgh 13, Pa. According to the company this new building provides ample space for stocking Link-Belt power transmission and materials handling products and serves as headquarters for the Pittsburgh personnel.

The new store is easily reached by all forms of transportation, being situated just three miles from the Golden Triangle, and only one block from the well-known intersection of Morewood Ave. and Baum Blvd.

★ Hot Applied Tar Base Coatings

★ Cold Applied Tar Base Coatings—Series 100

★ Alkyd Base Coatings—Series 200

★ Chlorinated Rubber Base Coatings—Series 300

★ Vinyl Base Coatings —Series 400

★ Phenolic Base Coatings —Series 500

Protective Coatings Booklet

Now Available

Booklet containing specific information on Pitt Chem Protective Coatings will be sent upon request.

See Your Nearest Pitt Chem Man

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PITTSBURGH COKE & CHEMICAL CO.

GRANT BUILDING, PITTSBURGH 19, PA.

OFFICES: New York • Chicago • St. Louis • Tulsa • Houston • Los Angeles • San Francisco

Attend the N.A.C.E. Convention in New York City, March 13th to 16th

204

Plastic Pipe Fittings

Carlon Products Corp., Cleveland, Ohio, announced the development and production of a completely new line of ells, tees, and couplings designed for

(*Continued on page 99a*)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(*Continued from page 98A*)

use with the newly developed Carlon "TL" threadable, rigid plastic pipe. These new fittings employ external shoulders which greatly increase their over-all strength.

Featuring International Pipe Threads, the new fittings are molded from a single piece of thermo-plastic material and are guaranteed against rot, rust, and electrolytic corrosion. They are extremely light in weight, can be handled rapidly and easily, and assure positive leakproof connections.

W. H. (Bill) Chamberlain Joins Builders-Pacific

Builders-Pacific Inc., Berkeley, Calif., has announced that W. H. (Bill) Chamberlain joined the company as Sales and Service Engineer in the Culver City, California branch office.

Chamberlain graduated from the University of California in 1947 and entered the employ of the Pacific Gas & Electric Co. where he was responsible for the operation and maintenance of all metering and control equipment at the Oleum Steam Plant.

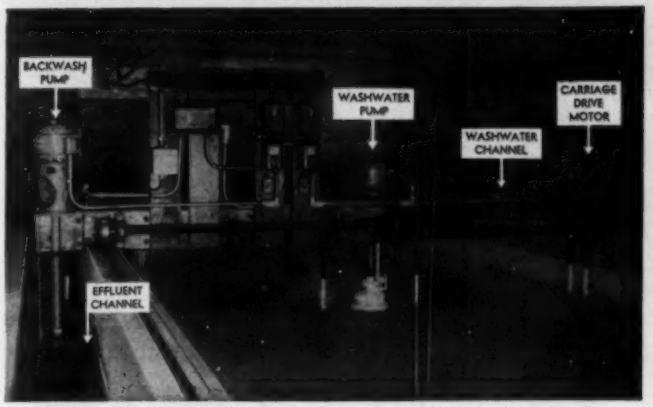
Returning to Stanford University for graduate work, he obtained his Master of Science in Mechanical Engineering in 1949 and in June of 1950 completed his academic work for his Engineer's Degree.

Worthington Appoints Leopold Asst. V.P.

Worthington Pump & Machinery Corp., Harrison, N.J., has appointed Wilbur R. Leopold as assistant Vice President. He will also function on Public Works projects, according to an announcement by W. H. Feldmann, Vice President in charge of sales. Mr. Leopold was formerly manager of Worthington's Detroit office.

Leopold started with Worthington in 1917 as a sales trainee in the meter shop in Harrison and later that year was appointed a meter salesman in the New York office. He became successively a meter representative for Pittsburgh in 1919, a general line

ABW FILTER REMOVES SUSPENDED SOLIDS IN Sewage & Trade-Waste Effluents

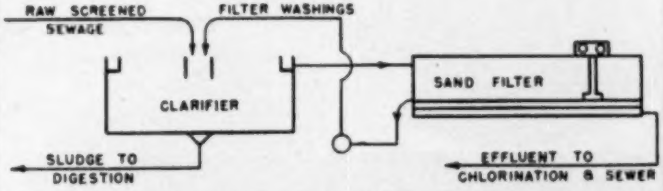


Typical trade waste installation of Hardinge Automatic Backwash Sand Filter

In the sewage treatment field, the use of the Hardinge ABW filter is attractive on sewage projects where a high removal of suspended solids is desirable but a high removal of B.O.D. is not necessary and ample dilution for the effluent is available. Preceded by a clarifier, operating on a 1½ to 2 hour retention period, the filter can remove 75 to 80% of the suspended solids not readily removed by sedimentation. If chemicals are added, a suspended solids removal of 90% and B.O.D. removal of 60% can be obtained.

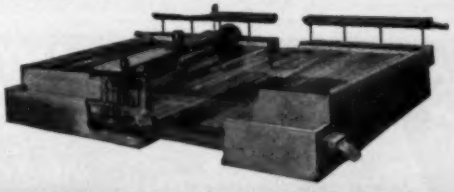
It may also be used to advantage on the effluents from final settling tanks in sprinkling filter and activated sludge sewage plants when a very high removal of suspended matter is required.

The use of the filter alone or in combination with a presettling tank appears advantageous on a large variety of industrial wastes.



Flow sheet for sewage or trade waste hook-up

No shut-down or "change-over" is necessary to backwash the Hardinge filter bed. It's all done automatically—a section at a time, without interfering with the normal filter operation. Write for Bulletin 46-15.



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Easy to lay MECHANICAL JOINT

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

The wide use of Standardized Mechanical Joint Cast Iron Pipe for water supply systems has created an urgent demand for Mechanical Joint Valves, Hydrants and Accessories. M & H has been a leader in recognizing this important trend and can supply AWWA Gate Valves with Mechanical Joint ends, in sizes 2" to 30" inclusive . . . Mechanical Joint Cutting-In Sleeves . . . and Mechanical Joint Hydrants in all sizes and all types.

M & H Mechanical Joint features are: Ease and speed of installation, construction economy, joint deflection, leak-tight, long life. Used with AWWA, Classes A, B, C, D,; Federal Specification WW-P-421; or Classes 100, 150, 200, 250 Centrifugal Pipe.

Fig. No. 67M

WRITE FOR
CIRCULAR No. 49

Our New Circular No. 29 shows important installation dimensions of M & H AWWA Mechanical Joint Hydrants and Valves . . . Underwriters and Associated Factory Mutual approved Post Indicator Valves . . . and Cutting-In Sleeves.

M & H Products • Everywhere

STOP WATER SEEPAGE SEWAGE CORROSION

WITH FORMULA No. 640

a clear liquid penetrating (1"+) sealer for concrete and masonry preventing water absorption and reducing the action of acids. Holds 12' hydrostatic head. Use our Hayproc Rubberized Enamel for color on walls and floors—not affected by concentrated acids, alcohol, oil, or traffic abrasion.

30 OTHER PRODUCTS
Write for technical data.

Haynes Products Co., Omaha 3, Nebr.
See our file in Sweet's

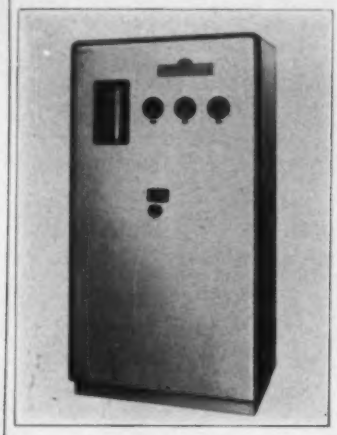
ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

salesman in Pittsburgh in 1928, and assistant sales manager of the Chicago office in 1932. From 1936 to 1945 he was Western manager of the railroad division and for the past five years he has been manager of the Detroit office.



205

High Capacity Chlorinizer

Builders-Providence, Inc., Providence, R.I., has introduced a new High Capacity Chlorinizer with feeding rates of from 100 to 6000 pounds per twenty-four hours. This high capacity unit has the visible gas flow feature and is fundamentally the same design as the lower capacity models.

To the basic HCVS manual Chlorinizer may be added Builders step control, automatic proportioning, semi-automatic or programmed control with no modification of the basic manual unit. The full feeding range of each unit is available with no change in the functional parts.

Pennsalt Names Roeller, Tunstall Asst. Gen. Sales Mgrs.

Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., has placed its six sales departments under the supervision of two Assistant General Sales Managers, it was announced by William P. Drake, Vice President and General Sales Manager.

Appointed to these newly created positions and reporting directly to Mr. Drake are R. S. Roeller, who will have general supervision of the Agricultural Chemicals, Heavy Chemicals and Special Chemicals Depts., and Arthur G. Tunstall, Jr., who will supervise the B-K and Household Products, Laundry and

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Dry Cleaning and Maintenance Chemicals Depts.

According to the company, the sales departments will continue to operate as heretofore. But under this change Mr. Roeller will have general supervision of sales of bulk or tonnage chemicals and sales to manufacturing industry. Mr. Tunstall will have general supervision of sales of chemical specialties to the service industries, food processors, and other light industry, and of consumer products.

Roots-Connersville Appoints Portland, Ore. Agent

Roots-Connersville Blower Corp., Connersville, Ind., has announced the appointment of the Koerner Engineering & Supply Co. of Portland, Oregon, as exclusive sales agents for all R-C products in the states of Oregon and Washington.

C. L. Koerner, who heads the organization, has had considerable paper mill experience in the area assigned to his firm.

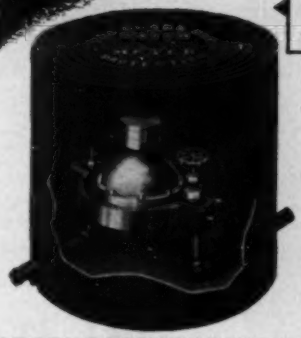
206

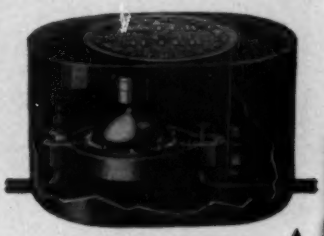
Compact Water Cooling Unit

Santa Fe Tank & Tower Co., Los Angeles, Calif., has designed a compact water cooling tower designed for efficient, economical operation, called an "Econotower". According to the company, the performance of these units is so fairly standard in application that Santa Fe engineers have designed them to be produced on a mass production scale. According to A. M. Kuehmsted, Santa Fe engineer, "this specialized production pattern has reduced unit costs while

CLARK METER BOXES AND COVERS

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.





Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

write

H. W. CLARK CO.

MATTOON, ILLINOIS

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A Royer Sludge Disintegrator at work in Reno, Nevada

SEWAGE SLUDGE IS VALUABLE ...SELL IT!

With a Royer Sludge Disintegrator you can take your sewage sludge cake right from the sludge beds and process it into a readily saleable fertilizer. Just shovel it into the hopper of the Royer, add commercial fertilizer as desired, and the Royer does the rest. Sludge cake with moisture content as high as 56% is completely shredded, pulverized and aerated . . . and at a labor cost less than that of burning or burying it. Sticks, stones and trash are removed and the finished product can be discharged into truck, pile or bags.

Florists and nurserymen, golf clubs and parks are ready customers for this valuable, nitrogen-rich plant food. Use a Royer Sludge Disintegrator . . . turn an expense item into a source of steady income.

A free copy of our Sewage Sludge Datalog giving all the facts will be sent to you upon request.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

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PAINTS OVER RUST!

RUSTREM STOPS RUST!

No priming, scraping, brushing

Rustrem paints right over rust. For stacks, fire escapes, bridges, fences, flashings...all metal. Farm, auto, marine, machinery. Black, aluminum, clear.

SPECO, Inc. 7308 Associate Ave. Cleveland 9, Ohio

Since 1886

"Ebony Paint Kills Rust"

A Refined Coal Tar Base Paint

No matter how old the job—5 to 25 years—rust has never been found under EBONY PAINT.

Specified by many Engineers for Sewage Disposal and Water Plants.

Quart sample and literature on request.

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18th & Agnes Ave.

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actually improving the quality of the cooling tower."

The Econotower is built in three distinctly different types: (1) horizontal flow, (2) vertical flow, (3) cylindrical vertical flow. Towers are completely prefabricated, ready for rapid erection, and feature a sturdy Redwood or metal shell construction.

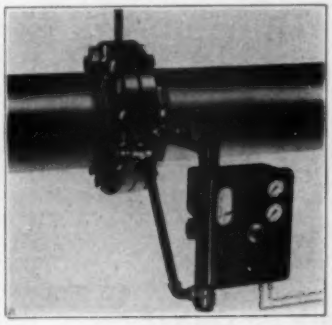
Rockwell Makes Gottwald Ass't V. P.

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced the appointment of H. Gottwald as Assistant Vice President of the Company's

Meter and Valve Division. For the past year he has been Assistant Sales Manager of Nordstrom Valve Division of the Company.

Prior to the move into Pittsburgh, Mr. Gottwald was Assistant Vice President of the Rockwell International Corp., handling all products of the Rockwell Manufacturing Co.

Mr. Gottwald started with the Company in 1928 as a sales engineer in the New York District office.



207

V/A Cell for Flow Transmitters

Fischer & Porter Co., Hatboro, Pa., has developed a V/A Cell which is a new, precision flow transmitter for differential pressure applications. Being basically a through-flow instrument of the variable-area type it measures a by-passed portion of the main-line flow. Continuous self-purging is thus provided. It features high ac-

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Gate Valves	Fire Hydrants
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Hydraulic Valves Motor Operated	Floor Stands
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SINCE IOWA 1909

We manufacture complete equipment for water and sewage flow control in Filtration Plants, Sewage Disposal Plants and Pumping Stations. Specify Iowa and let us solve your problems.

IOWA VALVE COMPANY

201-299 N. Talman Avenue, Chicago 80, Ill.

A subsidiary of James B. Clow & Sons

curacy with wide-range, linear scale. It is mercuryless but does not utilize a diaphragm of any kind. Manifold systems, bellows, seals, exterior purges, condensate chambers, are all eliminated. The V/A Cell is applicable to services on liquids, gas, and vapor streams including steam. 316 stainless steel is standard material for all wetted parts.

Coey Named Eastern Sales Mgr. For Hooker

Hooker Electrochemical Co., Niagara Falls, New York, through R. E. Wilkin, Gen. Sales Mgr., has announced the appointment of John S. Coey as Eastern Sales Manager of the company. At the same time, Thomas H. Trimble, formerly Eastern Sales Supervisor, has been made assistant Manager, Niagara Sales Office.

Mr. Coey, a graduate of Amherst College, has been with the Hooker Co. since 1937, first in charge of the Process Study Group and since 1943 as Manager of Sales Development.

American Cyanamid To Lease New Building In Chicago

American Cyanamid Co., New York, N.Y., announced that J. Emil Anderson & Son, Inc., have started construction of a 100,000 sq. ft. building in Chicago's Addison-Kimball District, which will be leased by the company. The building, designed to suit the company's requirements, will contain 80,000 sq. ft. of warehouse space on the first floor and 20,000 sq. ft. of air-conditioned offices on the second floor.

At present, the Cyanamid organization occupies office and warehouse space at a number of locations in the city of Chicago. According to the company, the main purpose to be achieved is the consolidation of these facilities so that the several divisions of the company may better serve Chicago and Midwestern customers.

208

Off Center Relief Valve

R-S Products Corp., Philadelphia, Pa., has recently developed an off center valve of the disc type and has American Standard raised face flanges. A double crank arm with adjustable weights facilitates accurate setting. The cylinder operates as a dash pot rather than as an actuator. They are also provided with a flanged outlet for overload relief.

BOND-O Homogenized

UNIFORMITY *brings you the perfect jointing compound*

Every ounce, every pound, every bag of BOND-O is identical in structure. Every cast iron pipe joint made with BOND-O —if made the same way—will perform in the same way. In short—if made with reasonable care—every BOND-O joint will be a perfect joint.

To the Water Works Engineer, the use of machine blended BOND-O means uniformity in strength — in tightness — in bonding — in initial seepage — in sealing. It means economy through the elimination of faulty joints . . . economy in man hours — and in money. It means that once a BOND-O joint is made, not another cent need be spent on it for maintenance. ***Proof of this is the fact that there has never been a single reported failure of a BOND-O joint!***

BOND-O

NORTHROP & COMPANY, INC.

SPRING VALLEY NEW YORK

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE • FLANGE PIPE • MECHANICAL JOINT PIPE • FLEXIBLE JOINT PIPE • SPECIAL CASTINGS • SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
55 LIBERTY ST. — N. Y. C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

Write Today For 66 Page Catalog
W. S. DARLEY & CO., Chicago 12

TG
SODIUM FLUOSILICATE
(Silico Fluoride)
Inquiries Invited
U. S. PHOSPHORIC PRODUCTS
Div. TENNESSEE CORPORATION
Box 3269 Tampa 1, Fla.

These valves are available in small and larger sizes for higher pressures and are used in air, gas, liquid and semi-solid service for control and shut off of volume and pressure.

Weimer Rockwell Ad. Manager

Daugherty Manager Market Research

Rockwell Manufacturing Co., Pittsburgh, Pa., named W. F. Weimer as Advertising Manager of the company on January 1st, 1951. He succeeds Wm. A. Marsteller, who resigned as vice president of Rockwell to establish his own company in Chicago.

Mr. Weimer has been associated with the Rockwell organization for more than a decade in the gas products sales department, as editor of employee publications, and, for the past several years, as advertising manager of the Pittsburgh Equitable Meter Division.

The company has also announced the appointment of A. C. Daugherty as Manager of Market Research. Mr. W. F. Rockwell, Jr., President, said the appointment was effective January 1, 1951.

Mr. Daugherty joined the company as a student engineer upon graduation from Penn State. In 1947 he became a market analyst in the Company's Market Research Department. He is a Director of the Pittsburgh Chapter of the American Marketing Assn.

Insul-Mastic Appoints New Directors

Insul-Mastic Corp., of America, Pittsburgh, Pa., has anonunced the appointment to the Board of Directors of Clifford Off, Jr. and Harry E. Rapp.

Mr. Off is Sales Manager of the company. He joined the staff in 1946 after having served with the United States Navy in the Pacific as Commander of an LST. He is a graduate of Princeton University.

Mr. Rapp joined the company in 1947 and now holds the position of Technical Director. He was formerly associated with the Carbosite Co. Mr. Rapp is a graduate of Northwestern University.

209

Phenoline for Concrete

Carboline Co., St. Louis, Mo., has developed a new material called Phenoline which makes the unskilled and inexpensive "acid proofing" of concrete floors possible. Phenoline is a brush-on phenol formaldehyde

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

coating that hardens at room temperature.

The company claims that in addition to being easy to apply, the new material is 2 to 9 times harder than conventional floor paints. Durometer readings are 85 to 90, compared with steel at 100. One primer coat and two finish coats are estimated to last 2 to 3 years on steps and other surfaces where considerable walking takes place. It resists organic and inorganic acids, except nitric acid, and is not recommended for alkalis although, so far, no solvent has been found to dissolve it. Phenoline is available in five different colors.

Literature and Catalogs

210

FLOATING COVER POSITION INDICATOR

Pacific Flush-Tank Co., Chicago, Ill., has issued a bulletin on the **Cover Position Indicator for Sludge Digestion Tanks.** This attractive two-color bulletin shows the complete operation of the indicator and states that any slight movement of the cover will move the indicator pointer without delay. High and low floating cover position warning alarm or motor control can be made part of this system.

Operation of the system, installation, dimensions and exploded-view diagrams as well as suggested specifications are included. Two engineering diagrams of suggested installations and breakdown of operating parts are inserted in the bulletin.

211

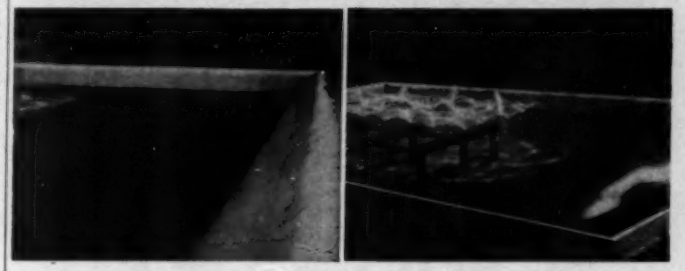
PUMP CATALOG

Yeoman Brothers Co., Chicago, Ill., have just issued a new condensed catalog covering the full line of **Yeoman Pumps,** of the corrosive and non-corrosive liquid types, solids-carrying liquids and dry and semi-dry material types.

The first section covers Corrosive and Non-Corrosive Liquids—with emphasis on vertical submerged centrifugal pumps, and horizontal end-suction circulating pumps.

Solids-Carrying Liquid pumps are featured in the second section and the horizontal and vertical non-clog centrifugal pumps to handle solids, in various styles and different bearing constructions; the Shone pneumatic unit—its application, operation and advantages are described.

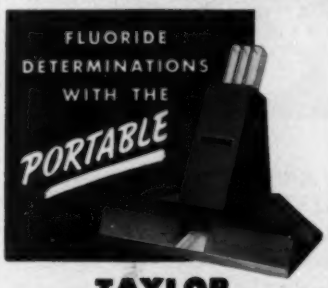
"GUNITE" FOR ECONOMY



Excessive leakage of reservoirs is an extravagance which no community need endure. Relining with "GUNITE" is less expensive than building new reservoirs and is more permanently water-tight than other methods of construction.

We relined this filtered water reservoir at Charlottesville, Va., in 1937. It is still in excellent condition. We have built, repaired and remodeled many reservoirs, in some instances increasing their capacities. Many examples of this and other types of "GUNITING" are shown and described in Bulletin C2400. Write today, on your letterhead, for your free copy.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN



TAYLOR WATER ANALYZER

You can make on-the-spot determinations of fluoride concentrations in municipal water supplies with the Taylor Water Analyzer. Fluoride slide gives readings from 0 to 1.6 p.p.m. from a single slide containing all necessary color standards. No fragile, expensive Nessler tubes to handle. No danger of inaccuracies since all color standards *carry an unlimited guarantee against fading.* Complete set includes base, slide and three sample tubes. Slides for pH, chlorine, silica, iron content and many more can be used on same base.

FREE BOOKLET! Write today for your free copy of "Modern pH and Chlorine Control". 96 pages of valuable data on water analysis and treatment for water and sewage plant operators. SEE YOUR DEALER FOR TAYLOR EQUIPMENT.

W. A. TAYLOR AND CO.
2108 YORK RD. • BALTIMORE 4, MD.

AMONG MEN WHO KNOW

THE ELLIS PIPECUTTER *is BEST* FOR CUTTING LARGE SIZES OF PIPE

No. 01 Cuts Pipe 4" to 8" | No. 1 Cuts Pipe 4" to 12"

WRITE FOR CIRCULAR AND PRICE LIST "NO. 33WS" ON OUR COMPLETE LINE OF PIPE CUTTING TOOLS.

ELLIS & FORD MFG. CO.
FERNDALE 20, MICH.

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Valve closes with water pressure
When broken in a traffic accident, some hydrants may release a stream of water which not only lowers pressure, but also causes costly damage to property. Not so the Mathews. Its compression-type valve stays seated.
MATHEWS
HYDRANTS
Made by R. D. Wood Company
Public Ledger Building, Independence Square, Philadelphia 5, Pa.
Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

MATHEWS MODERNIZED HYDRANTS OFFER THESE ADVANTAGES: All working parts contained in quickly replaceable barrel • Stuffing box cast integral with nozzle section—positively leakproof • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for extra strength, toughness, elasticity • Modern barrel makes an old Mathews good as new • Mechanical joint pipe connections, too

STOP
JOINT LEAKAGE
USE
CARSON CLAMPS
With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.
Write for Prices.
Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

Phipps & Bird
LABORATORY MIXER
is the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.

Cast Iron Bell and Spigot Water Pipe
At A Drastic Reduction In Price
10" Class B—14,736 feet
Also
8" Class 250—4,328 feet
Excellent Used Condition
Immediate Delivery Below Mill Price
WRITE—WIRE—PHONE
SONKEN-GALAMBA CORPORATION
2nd and Riverview (X-428)
Kansas City 18, Kansas THatcher 9243

The third and final section describes the Dry and Semi-Dry Materials pumps—especially the Yeoman "Transporter" for handling bulky materials—along with suggested applications and operation.

212

PLASTIC PIPE CATALOGS

Carlon Products Corp., Cleveland, Ohio, has announced the availability of a series of five different 4-page, illustrated, multi-colored catalogs.

The series consists of one general brochure and four booklets which cover **Carlon "E," "EF," and "T" plastic pipe** and **Carlon "C" plastic tubing** respectively.

The general brochure, entitled "Carlon Plastic Pipe," covers six types of flexible and rigid plastic pipe and tubing recommended for a wide variety of applications ranging from drainage and sewage handling to the transmission of hydrofluoric acid. Included in this publication are the applications for which each pipe has been especially developed. Specifications and physical properties are also charted.

213

SURGE RELIEF VALVE

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a new 8-page bulletin containing complete information on the **Cushioned Surge Relief Valve.** The

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

bulletin features detailed sectional diagrams of the new valve (2 to 8 inches with pressed-in liner, 10 inch and larger with flanged liner, the relief pilot valve, and general installation arrangements). Parts, materials, and dimensions are tabulated, and valve adjustment, servicing, operation, and other considerations are described and discussed.

214

FLOW METERS

Hays Corporation, Michigan City, Ind., has published a 16-page bulletin on **Hays-Penn Friction Free Electric Type Flow Meters.** This attractive two-color bulletin states that the reasons why the meter is highly accurate and stays accurate are: because the friction free transmitter acts merely as a pilot—an auxiliary motor does the work; the receiver utilizes an individually calibrated cam; special design meters quickly and positively checked and, are explicitly guaranteed. Cut-away drawings, diagrams and photographs fully illustrate the operation and working parts of the meter.

The bulletin also discusses the Hays-Penn gas or air flow recorders, boiler-efficiency meters, Hays-Penn linameter and Liquid Level meters—both differential pressure and submerged types.

215

LINING STEEL PIPE

Koppers Company, Inc., Pittsburgh, Pa., in the October issue of **Bitumastic Bulletin** describes the complete operation of how hot Bitumastic 70-B Enamel lining and coating was done in the field near the pipe line right-of-way.

Each step of the operation is fully explained and photographs show how the operation was accomplished and how the assembly-line technique was applied.

216

WATER, SEWAGE, INDUSTRIAL WASTE EQUIPMENT

Jeffrey Manufacturing Co., Columbus, Ohio, has made available their 52-page catalog on **Jeffrey Equipment for Water, Sewage and Industrial Waste Treatment.**

This attractive catalog, by means of text, photographs and drawings covers the complete line of Jeffrey equipment for treatment plants and includes: Bar and Disc Type Screens; Screening Grinders; Grit Collectors and Washers; Sludge Collectors for Primary and Final Settling Tanks; Sludge Elevators,

LATEST EDITION
CATALOG No. 600-10
MANY NEW TESTS
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217

HYDRAULIC BOOSTER PUMP

Ross Valve Manufacturing Co., Inc., Troy, N.Y., has made available a booklet covering the **Installation, Operation and Maintenance of the Ross Hydraulic Booster Pump.**

Featured in the front of the booklet is a complete cut-away drawing of the pump and engine showing in great detail every part of the entire equipment by name and number. Accompanying this drawing is a discussion of the principal parts of the pump, theory of operation, installation instructions, operating suggestions and difficulties.

Two piping diagrams covering the 2 inch and the 3 inch pumps complete the booklet.

218

FLEXIBLE COMPRESSION FITTINGS

Dresser Manufacturing Division, Bradford, Pa., has just published an attractive two-color catalog on **Dresser Flexible Compression Fittings** for pipe sizes up to 2 inches. The catalog is amply illustrated with photographs of actual installations, diagrams on the method of applying the fitting and 12 typical uses taken from case histories. Complete specifications, dimensions and weights of these "No-thread" fittings are included. Ordering information and a short discussion on the couplings for pipe sizes larger than 2 inches are given on the back pages.

219

PIPELINE TRENCHERS

Thew Shovel Co., Lorain, Ohio, has just published a new bulletin on **Lorains on Pipeline Construction** which features the application of Lorain power shovels and cranes to pipeline construction. This colorful and heavily illustrated 12-page book gives special attention to the Lorain "Pipeliner", a specially designed hoe with wide gauge crawlers to straddle pipeline ditches. Application of other types of Lorain equipment such as clamshells, draglines and cranes is also depicted. Also included is the story of the use of rubber-tire Lorain Moto-Cranes for pipelining and how they can roll long distances quickly to widely separated jobs.

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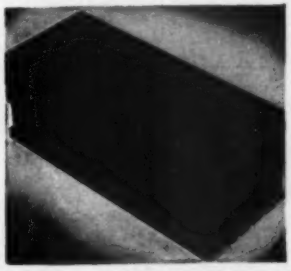

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220

PNEUMATIC WATER WORKS GAUGES

Builders-Providence, Inc., Providence, R.I., has issued a new bulletin on **"Pneumatic Water Works Gauges."** Included in this four page bulletin is a discussion of the features, description and operation of these pneumatic units. Also included is a discussion of the application of the devices to the summation of several flows. Illustrations are presented on both transmitting and receiving units as well as photographs of various types of indicating and recording dials and instruments.

The back page of the bulletin shows a diagram of a typical filter control installation using pneumatic loss of head and rate of flow gauges. Also shown is a photograph of the master control table for pneumatic instruments at the South District Filtration Plant in Chicago.

221

HISTORY OF CHEMISTRY

Mallinckrodt Chemical Works, St. Louis, Mo., has just published an outline of the **History of Chemistry.** This multi-color 35 x 35 inch illustrated wall chart presents the history of chemistry from its origins in China, India and Egypt up to 1950. This valuable chart is based on an earlier outline by Dr. Nottis W. Bakestraw, editor of the Journal of Chemical Education, and has been brought up-to-date by Herbert S. Klickstein. Mr. Klickstein is a member of the Advisory Board to the Edgar Fahs Smith Memorial Library, University of Pennsylvania, and an editor of CHYMIA, the international journal of chemical history. To anyone using chemicals this chart will prove a valuable asset to their library.

222

DIESEL ENGINE BOOKLET

Murphy Diesel Co., Milwaukee, Wis., has offered a new 28 page booklet entitled **"10 Questions to Ask a Diesel Engine Salesman."** The booklet asks and answers ten questions pertaining to diesel engine design and gives full mechanical details on the Murphy Diesel line of engines.

223

POPPET TYPE MULTIPORT VALVE

Hungerford & Terry, Inc., Clayton, N.J., has made available an 8-page bulletin on the **H & T Poppet Type Multiport valve** for manual, semi-automatic, or fully automatic operation of water softeners or water filters.

The bulletin states that this poppet type multiport valve was developed in answer to a need for a valve to control the passage of water to a water softener or filter machine in which there must be no leakage. Also discussed is the ease with which the valve can be operated, the foolproof operation is explained and the operating position shown.

The results of a test performed with the valve to prove that it is non-sticking and non-leaking are discussed along with description of the automatic wash and rinse cycle, the

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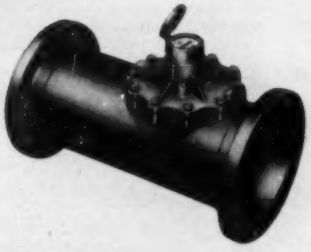

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Illustrations, diagrams, photographs and a short report on H & T electric control panels complete the bulletin.

224

TAPPING PRESTRESSED CONCRETE PIPE

Price Brothers Co., Dayton, Ohio, has published a 4-page, two color brochure on **Tapping Prestressed Concrete Steel-Cylinder Pipe Under Pressure.** This brochure describes in detail how any waterworks serviceman with conventional type tapping equipment can tap Prestressed Pipe under pressure.

The entire center spread of the brochure shows by photographs and text the step-by-step operations of tapping small diameter and large diameter connections. The back page is devoted to a cutaway diagram and description of the construction of prestressed concrete steel-cylinder pipe and how to make permanent, watertight connections.

225

LIQUID RHEOSTAT

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just published a leaflet describing the construction and operating features of **Allis-Chalmers Liquid Rheostat**—Type 257—which provides stepless, wide range speed control of wound rotor motors.

According to the leaflet, the rheostat is safe, compact and has only a few moving parts, and gives full resistance range in 10-inch travel, which is only ¼ to ⅓ that often required for other units. The leaflet also states that the rheostat is suitable for load absorption and motor starting applications.

226

LABORATORY GLASSWARE

Corning Glass Works, Corning, N.Y., has just published supplement **C** to catalog LP 28 covering their **Laboratory Glassware.** This 74-page catalog covers the products made of Pyrex and Vycor brand laboratory ware. The items are listed alphabetically and by type number. Explanations after each listing include size, quantity per package, net price each, net price per package and prices in lots of 20, 50 and 100 packages. Ordering information and information on special apparatus complete the catalog.

227

ELECTRIC MOTOR LUBRICATION

U. S. Electrical Motors, Inc., Los Angeles, Calif., has issued a new bulletin entitled **"Lubriflush"** which contains interesting studies on bearing lubrication for electrical motors. It graphically shows comparative amounts of lubricant used in different designs of bearings and how bearings are subject to air circulation. Application of U. S.'s Lubriflush principle is presented, showing how bearings can be lubricated for life and also can be purged of old lubricant and renewed without disturbing the bearing housing.

228

INVERSAND WATER SOFTENERS

Hungerford & Terry, Inc., Clayton, N.J., has just prepared a new bulletin **V-11,** illustrating and describing its various types of fully automatic and semi-automatically operated Inversand zeolite water softeners. This bulletin features the

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company's new poppet type multiport valve which is built in many sizes and for both sodium cycle and hydrogen cycle ion exchange work.

229

MOTOR STARTERS

Allis-Chalmers, Milwaukee, Wis., has released a new 12 page bulletin describing the company's **Type H Motor Starters** for 2300 to 5000-volt squirrel cage, wound rotor, synchronous and multispeed motors.

The bulletin states that the starters are built for full voltage or reduced voltage, reversing or nonreversing, with plugging, dynamic braking and multi-speed features. Also described are contactors (air break or oil immersed), protective devices, meters and relays.

230

BULLETIN & EQUIPMENT INDEX

Schutte and Koerting Co., Philadelphia, Pa., have just issued a new products list folder, entitled **Index of SK Equipment and Descriptive Bulletins.** The folder list SK products according to application and alphabetically, together with the numbered descriptive bulletin pertaining to each product. Schutte and Koerting products are mainly applicable to the Water & Sewage Works field.

231

BRASS-COPPER PIPE CORROSION

Water Service Laboratories, Inc., New York, N.Y., has just released a new bulletin entitled **Corrosion of Brass Pipe and Copper Tubing.** The bulletin describes the corrosive effect of water on the different kinds of brass pipe, and on copper tubing; and describes the procedure that can be used to minimize the damage done by such corrosion. Also included is a list of references stating sources of further detailed information.

232

SINGLE-PHASE REPULSION MOTORS

Star-Kimble Motor Division, Bloomfield, New Jersey, has just published a bulletin on **Star-Kimble A-C Single Phase Repulsion Motors.** The bulletin describes in detail these 1/6 to 3 hp. continuous-duty, varying-speed motors. Illustrations of the different speed and operating remote controls and data on current consumption at varying speeds is also included.

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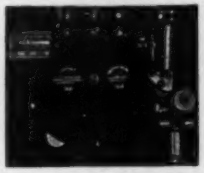
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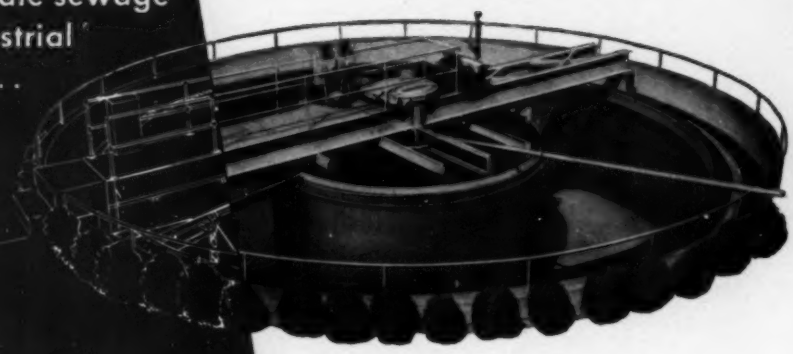

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CINCINNATI 26, OHIO

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